PACIFIC ISLANDS FISHERIES SCIENCE CENTER

Estimating Catch Weight of Reef Fish Species Using Estimation and Intercept Data from the Hawaii Marine Recreational Fishing Survey

Ivor Williams
Hongguang Ma

November 2013

Administrative Report H-13-04

About this report

Pacific Islands Fisheries Science Center Administrative Reports are issued to promptly disseminate scientific and technical information to marine resource managers, scientists, and the general public. Their contents cover a range of topics, including biological and economic research, stock assessment, trends in fisheries, and other subjects. Administrative Reports typically have not been reviewed outside the Center. As such, they are considered informal publications. The material presented in Administrative Reports may later be published in the formal scientific literature after more rigorous verification, editing, and peer review.

Other publications are free to cite Administrative Reports as they wish provided the informal nature of the contents is clearly indicated and proper credit is given to the author(s).

Administrative Reports may be cited as follows:

> Williams, I., and H. Ma. November 2013. Estimating Catch Weight of Reef Fish Species Using Estimation and Intercept Data from the Hawaii Marine Recreational Fishing Survey. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Pacific Islands Fish. Sci. Cent. Admin. Rep. H-13-04, 53 p.

For further information direct inquiries to

Chief, Scientific Information Services
Pacific Islands Fisheries Science Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce
2570 Dole Street
Honolulu, Hawaii 96822-2396

Phone: 808-983-5386
Fax: 808-983-2902

Pacific Islands Fisheries Science Center
Administrative Report H-13-04

Estimating Catch Weight of Reef Fish Species Using Estimation and Intercept Data from the Hawaii Marine Recreational Fishing Survey

Ivor Williams
Coral Reef Ecosystem Division
Pacific Islands Fisheries Science Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
1601 Kapiolani Boulevard, Suite 1000
Honolulu, Hawaii 96814

Hongguang Ma
Fisheries Research and Monitoring Division
Pacific Islands Fisheries Science Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
2570 Dole Street
Honolulu, Hawaii 96822

November 2013

SUMMARY

NOAA's Marine Recreational Information Program (MRIP) generates expanded estimates of catch number and weight for individual species/taxa using a combination of catch and trip data from onsite intercept surveys, and effort estimates from telephone surveys.

MRIP harvest estimates (# of fishes landed) are generated for each wave (2-month period) and converted to catch weight estimates only for those records that have mean weight estimates derived from weight measurements from intercept surveys in the wave.

In MRIP's default estimation, the catch weight is left as missing if there are no weight measurements for that species/taxa in a specific fishing area and fishing mode combination and there are < 2 weight measurements for all fishing areas and modes combined (in a wave). That situation is common for reef fish species in Hawaii – for those, approximately two-thirds of the catch number estimate records have no weight estimation.

Here we use a variety of methods to acquire appropriate substitution weights for catch records with missing weights, including deriving mean weight from the entire 8-year intercept data set; increasing the number of useable intercept records by estimating weight from length using length-to-weight conversion; and using substitution weights from other sources (39 of 136 reef fish species with estimated MRIP catch number in 2004-2011 had no weight or length measurements from intercept surveys).

The updated catch weight estimates, using various substitution mean weights for catch number with missing weight, indicate mean annual catch of 245,333 lbs for surgeonfish, 82,075 lbs for parrotfish, and 216,472 lbs for goatfish. These are > 2 to > 13 times the values of MRIP's catch weight estimates without our substitutions.

CONTENTS

OBJECTIVES AND BACKGROUND

The goal of the work covered in this report was to use information gathered by NOAA's Marine Recreational Information Program (MRIP) to generate reef fish catch estimates during the years 2004-2011 in Hawaii. The goal is to provide an explicit and transparent means to generate substitution weights (i.e., a mean weight per fish caught per taxon and fishing mode) for MRIP expansion records that include estimated harvest (number of fish caught) but not estimated catch weight. The frequency with which that occurs, our approach to generating substitution weights, and the reassessed MRIP catch estimates are described below.

Introduction to the Marine Recreational Information Program/Hawaii Marine Recreational Fishing Survey/Marine Recreational Fisheries Statistics Survey Programs

MRIP is the new method used by NOAA Fisheries to count and report marine recreational fishery catch and effort. MRIP has replaced the Marine Recreational Fisheries Statistics Survey, or MRFSS. MRFSS as a national program started to conduct recreational fishing surveys in the continental United States in 1979. MRFSS also covered Hawaii at the beginning but it only lasted for 2 years in Hawaii due to funding and staffing restrictions. The Hawaii Marine Recreational Fishing Survey (HMRFS) as part of MRFSS was reinstituted in 2001. The survey initially began in Oahu in 2001 for the private boat sector. The survey expanded to neighbor islands and to other sectors (including shore sectors and for-hire sectors) in 2002-2004. The for-hire sector was eliminated at the beginning of 2007. Catch and effort estimates can be made from HMRFS starting in 2003. However, MRIP re-estimation only applied for years after 2003, and only data covered by MRIP re-estimation have been compiled/archived in a new way. Therefore, only 2004-2011 data were used for this report.

In MRIP, the catch for individual species is estimated for every 2-month period ('wave') based on the catch rate (number of fish per angler- trip) from on-site intercept surveys and fishing effort estimates (number of fishing trips) derived from the Coastal Household Telephone Survey (CHTS). On-site intercepts involve MRIP staff interviewing fishers at marinas, boat ramps and shore-fishing sites about the fishers' trip and catch. In addition, where permission was granted, MRIP staff measure size and/or weight of portions of the catch. The sampling for those onsite intercept surveys is stratified by fishing mode (including shoreline fishing and fishing from private boats), months within a wave, and by island (county). Overall, intercept surveys provide the information that is used to estimate average catch per fishing trip, and mean size and weight of fish per species, wave, and fishing mode.

The telephone survey is stratified by county (island). The fishing effort estimation from CHTS is adjusted for households not covered by CHTS (out-of-state households and households without landline telephone), based on ratios from the onsite intercept surveys. Since fishing mode is only determined during the actual telephone interview (not identifiable prior to sampling), fishing mode

in CHTS defines a domain for estimation (a subpopulation of the target population) with a random sample size.

The catch rate estimation from onsite intercept survey is post-stratified by fishing areas including inland (bays, estuaries, and sounds), ocean 3 miles or less from shore, and ocean more than 3 miles from shore. The fishing effort estimates are further partitioned into those three different fishing areas, depending on the proportion of fishing trips from different areas determined from the onsite intercept surveys.

The catch estimate for each fishing mode and area combination is the product of catch rate and fishing effort (Fig. 1). The catch is estimated for catch number first (e.g., number of fish harvested). The catch weight is the product of catch number and mean weight in the estimation domain (fishing mode * fishing area combination, per wave). If there are no weight measurements for a species in the estimation domain, the mean weight from the state for that wave (including all modes and all areas) is used as a substitution-weight. At least two weight measurements in that wave are needed for substitution.

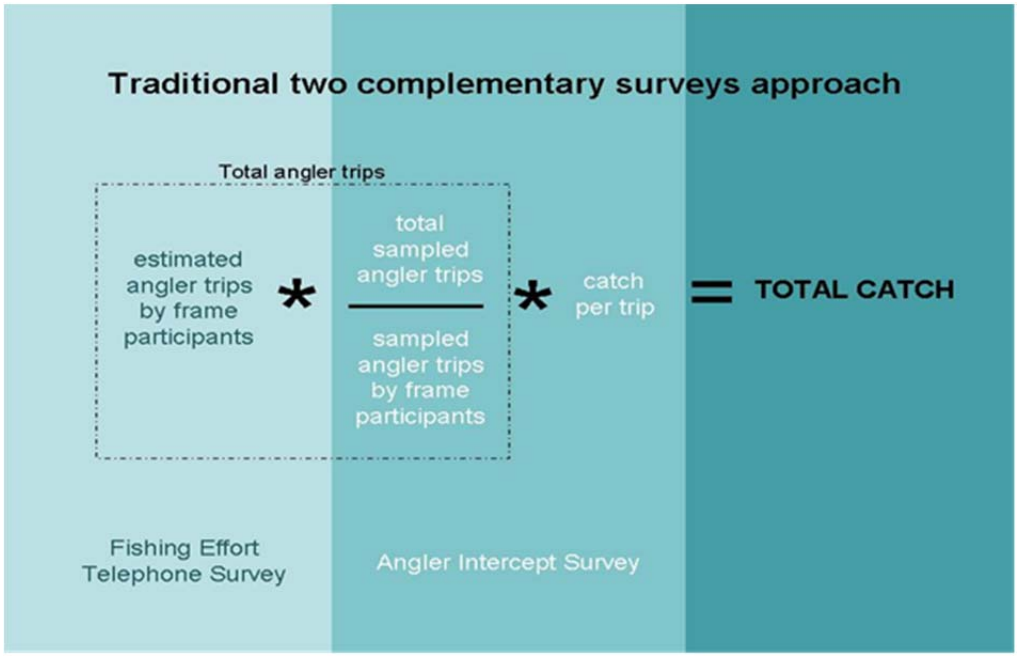

Figure 1.--**MRIP Schematic.** Frame participants in the marked box are the anglers covered by CHTS (from Hawaii households with landline telephones). The total sampled angler trips (in angler intercept survey) include anglers from other states and from households without landline telephones (i.e., out-of-frame participants). Total anger trips and catch per trip are estimated for each fishing mode (shoreline fishing and fishing from private boats) and fishing area (inland, ocean 0-3 miles, and ocean > 3 miles) combination.

When MRIP is Unable to Estimate Catch Weights for Catch Expansions

If there are no weight measures in an estimation domain (fishing mode and fishing area combinations in a wave) and there are fewer than 2 measured weights for all fishing modes and areas combined, the weight estimation will not be available and remain as missing. The MRIP Web site glossary (http://www.st.nmfs.noaa.gov/recreational-fisheries/access-data/glossary/index) explains this as:

"After weight-substitution, if the mean weight is STILL missing, we give up and leave a missing weight estimate. At that point,

- *It is up to the user to determine whether to substitute, and*
- *What substitution is most appropriate to use (a mean from the preceding and following waves, the whole year, same wave over years, whole Atlantic & Gulf coast, some complicated regression model, whatever).*
- *We don't make those decisions because the information needs and sensitivity of the data vary among species.*

The phenomenon of missing weights is more widespread with rarely caught species and with large fish (i.e., tunas). The existence and/or extent of missing weights for your query can be examined by requesting data at the cell level: (by year/wave/state/by mode/by area/by species (time series))".

For Hawaii reef fishes (defined in Table A3), the situation of missing weights is common. In fact, for the catch expansions from 2004 to 2011 used for this report, around two-thirds of all expanded catch records have missing weights. This may be due to the fact that large number of reef fish species were taken and therefore appeared in MRIP expansions (137 taxa between 2004 and 2011).

The goal of this work is to generate best possible weight estimates to substitute into MRIP expanded catch estimates (when the weights are missing) and to update the default MRIP catch estimates to capture the recreational catch (weight) for Hawaiian reef fish species.

METHODS

Data Sources

The data used come from the MRIP website, with catch estimates downloaded as csv files[1] and intercept survey data[2]. We used all catch estimate and intercept data from 2004 to 2011, the full final data set available to us at the time of producing this report.

[1] http://www.st.nmfs.noaa.gov/st1/recreational/MRIP_Estimate_Data/
[2] http://www.st.nmfs.noaa.gov/st1/recreational/MRIP_Survey_Data/

We used following values from the catch estimate files:

- '**ST**' (US state, = 15 for Hawaii)
- '**sp_code**' a 10-digit unique code per fish taxon (Table A3)
- '**landing**', which is labeled as 'Total Harvest A+B1', and description is '*the total number of fish removed from the fishery resource. May be obtained by summing catch types A (CLAIM) and B1 (HARVEST)*'. 'Landing' does not included fishes caught but released alive.
- '**lbs_ab1**', which is labeled as 'Harvest (A+B1) Total Weight (lb)', with description of '*Total weight (lb) of all fish removed from the fishery resource (LANDING, A+B1) by species on trip*'). As described above, lbs_abl1 is left blank in instances when MRIP does not generate a mean weight estimate or substitution-weight.
- '**wave**' (a numeric value of 1-6: 1=Jan-Feb, 2=Mar-Apr; etc.) and '**Year**'.
- '**mode_fx**' (fishing mode). For Hawaii values were either: 3 ('Shore'), 5 ('Charter Boat') or 7 ('Private Boat').

We used following values from the intercept files:

- '**ST**', '**SP_CODE**', '**WAVE**', '**YEAR**', and '**MODE_FX**' which have same meanings as in catch estimate files.
- '**WGT**', which is labeled as 'Weight of fish (KG)' and with description '*Weight of fish in kg at time of interview (round, wet, or live weight)*'.
- '**LNGTH**', which is labeled as 'Fork Length of fish (mm)'.

Henceforth, we use the simpler terms '**HARVEST**' in place of 'landing', and '**CATCH_WEIGHT**' in place of 'lbs_ab1'. Because there were very few records with mode_fx of 5, we generated a variable '**MODE**' with values of either BOAT (mode_fx = 5 or 7) or SHORE (mode_fx=3). We also use the term '**WAVE**' to mean a wave within a particular year.

We used the following values from the CRED reef fish survey database:

- **LW_A**, **LW_B**, and **L_CONV**, which are species-specific length-to-weight conversion factors (LW), largely taken from FISHBASE (Froese and Pauly 2010) or from a study by Kulbicki and colleagues (Kulbicki, Guillemot et al. 2005). The length-weight conversion formula is: W(g) = LW_A * (LENGTH(cm)^LW_B). Intercept lengths are for fork-length [FL]. Although the majority of length-weight parameters are for FL, some are for standard-length or total-length. L_CONV is a conversion parameter to convert length as fork-length to the appropriate length-type for the other LW parameters (and where LW parameters are for FL, L_CONV is 1).

Commercial catch data are taken from Hawaii Division of Aquatic Resources (DAR) Commercial Marine Landings Summary Trend Reports, available on the DAR website.[3]

Throughout this document, we report catch and substitution weights in pounds, as those are the typical reporting units for fishery catch in Hawaii.

[3] http://hawaii.gov/dlnr/dar/fishing_commercial.html

Taxa of Interest

We limited our estimates of catch weights to reef fish species, being species that are associated with hardbottom coral reef habitats in their adult life stages. We therefore excluded fishes that are pelagic or bottomfish (e.g., tuna, dolphin-fish, herring, deep-water snappers), or found mainly in softbottom habitats (e.g., mullet, bonefish). Our classification of ‘’reef’ and ‘non-reef’ taxa in MRIP estimation files are shown in Appendix A. Reasons for making the reef/non-reef distinction include: (i) we were primarily interested in generating catch estimates for species that are regularly encountered during visual surveys by NOAA PIFSC CRED during Hawaii reef assessment surveys; and (ii) assumptions about suitable substitution weights for reef fish species, which tend to be long-lived and relatively slow-growing, may be less suitable for non-reef species (e.g., mean weight can vary substantially from year to year for some pelagic species).

Calculating Substitution Weights

Utilizing intercept lengths to increase # useable intercept records

To increase the number of useable intercept records, we used length-weight parameters to estimate weight for intercept records with measured lengths only (no measured weights). Weights were estimated from lengths, using the LW conversion parameters shown in Table A3. Good concordance between intercept weights and weights generated from intercept lengths (Figure A1) indicates that this is a robust approach to increasing the size of the intercept data set that can be used for estimating the mean weight for substitution.

For reef fishes, this approach increased the number of useable intercept records from 1476 (records with an intercept weight) to 2343 (records with either an intercept length or weight), and increased the number of reef fish taxa with intercept weight information (measured weight, or weight estimated from measured length) from 78 to 96.

However, even with that expanded intercept data set, there were relatively few measurements from intercepts for most reef fish species: of the 97 species with weight or length measurements, the median number of measurements across all of 2004–2011 was 5 (i.e., < 1/yr over the 8-year period), and only 17 species averaged 5 or more measurements per year (Table A3).

Taxa with no intercept data

There were 39 reef fish taxa with catch estimates but no weight or length measurements. For those taxa, we calculated a mean weight (for substitution) using an assumed typical harvest size for the taxa, together with the appropriate LW parameters (Table A3).

Scope for use of substitution weights per year or wave

As described above, MRIP only generates substitution weights from measured weights made within a wave (i.e., a 2-month period). While there can be significant seasonal or interannual variability in mean weights of harvested fishes, it is likely of less concern for the majority of the relatively long-lived and slow-growing reef fish species that we are interested in.

In addition there would be little gain in generating annual (or more frequent) mean weight estimates for substitution given the small number of intercepts for most reef fish species. For example, if we set a standard of having more than 5 intercepts in a year for us to be able to generate annual estimates, only 2 reef fish species: the bluefin trevally (*Caranx melampygus*) and the convict tang (*Acanthurus triostegus*) met that standard in each year between 2004 and 2011. We therefore do not calculate annual substitution weights per species, but instead calculate substitution weights as the mean of all intercept records from 2004 to 2011.

Calculating substitution weights by MODE ('shore' or 'boat' fishing)

Following the same general approach as MRIP, we attempted to generate substitution weights per species separately for 'boat' and 'shore' fishing where there were sufficient intercept records for each of those fishing modes. Somewhat arbitrarily, but in keeping with the MRIP standard for calculation of a substitution weight for a wave, we set a minimum of 2 intercept measurements for each of 'boat' and 'shore' fishing to justify separately estimating substitution weight by fishing mode. Of the 136 reef fish species with catch estimate records, only 37 species met that standard, i.e., have 2 or more 'boat' and 2 or more 'shore' intercept records with measured length or weight in the entire 2004-2011 period.

For those 37 species (Table A3), we therefore calculated substitution weights separately for boat and shore fishing – those being the mean of all measured or estimated intercept weights for that species and fishing mode. For the remaining 60 species with intercept weight or length measurements, we calculated a single substitution weight to use irrespective of fishing mode (i.e., average of all intercept weights for that species).

RE-ASSESSING MRIP CATCH ESTIMATES

As described above, we derived substitution weights for all reef fish species that appear in the 2004–2011 MRIP catch estimates, and for 37 of those species we generated separate substitution weights for 'boat' and 'shore' fishing (Table A3).

We used those values to estimate catch weight for all MRIP estimated catch records with HARVEST > 0 but CATCH_WEIGHT = 0 or null (i.e., some number of fish were landed, but

MRIP unable to estimate a catch weight for that record). Specifically, for each record, we multiply the number of fish caught (HARVEST) by the appropriate substitution weight for that species (and, in some cases, also for the specific MODE). Therefore, we left CATCH_WEIGHT estimates where they have been made by MRIP, and only used substitution values for instances in which MRIP was not able to generate substitution weights.

For catch estimate data from 2004 to 2010, we divided catch totals (HARVEST and CATCH) by 1.22, which is a correction factor to account for an error in the population household number for Maui County that was identified in 2010, and which affected the number of fishing trips used to generate catch estimates. More information on that error is given in a PIFSC internal report IR-12-010 'Catch and Effort Estimates for 2003–2010 from the Hawaii Marine Recreational Fishing Survey'.

We summarize total CATCH_WEIGHT per family and taxa for individual years in 2004–2011 and the mean of annual catch for the 2004–2011 period (Table 1). For completeness, we also show total HARVEST (# fish landed) per family and taxa (Table 4) – the only adjustment we made to those numbers being the correction to account for overestimation of effort in 2004–2010 described above.

RESULTS

Re-assessed MRIP Reef Fish Catch

Table 1.—Annual estimated catch (lbs) and mean (2004-2011) by family and species for all reef species.

Family	Common Name	TOTAL CATCH (lb) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
Acanthuridae	ACHILLES TANG	-	-	-	6,555	3,500	-	1,709	125	1,486
	BLACK SURGEONFISH	-	21,222	-	10,885	117	5,099	21,525	4,391	7,905
	BLUE SPINE UNICORNFISH	26,942	43,187	28,738	21,216	11,486	27,318	21,820	8,986	23,711
	BLUELINED SURGEONFISH	-	2,197	559	-	-	-	304	-	383
	BROWN SURGEONFISH	-	-	-	-	-	-	39,867	-	4,983
	CONVICT TANG	45,772	120,921	123,354	23,302	40,344	197,691	66,569	53,909	83,983
	EYESTRIPED SURGEONFISH	29,005	41,407	36,580	14,159	26,036	26,587	54,581	61,600	36,244
	GOLDRING SURGEONFISH	57,600	39,072	42,060	24,329	39,597	68,965	35,565	27,011	41,775
	ORANGEBAND SURGEONFISH	936	749	2,531	-	-	-	15,833	-	2,506
	ORANGESPINE UNICORNFISH	8,820	-	2,659	-	3,695	-	1,109	-	2,035
	PALETAIL UNICORNFISH	-	-	-	-	-	-	-	144,609	18,076
	RINGTAIL SURGEONFISH	-	13,679	1,084	5,267	-	-	-	1,607	2,705
	SLEEK UNICORNFISH	-	7,705	-	-	6,146	14,892	-	-	3,593
	SURGEON FISH FAMILY	-	-	-	-	-	-	-	162	20
	UNICORN SURGEON GENUS	2,471	516	-	-	1,512	1,048	-	517	758
	WHITE BAR SURGEONFISH	-	-	-	69	-	-	-	-	9

Table 1 (continued)

Family	Common Name	TOTAL CATCH (lb) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
	WHITEMARGIN UNICORN	17,045	14,310	5,980	584	-	8,795	2,663	-	6,172
	YELLOWFIN SURGEONFISH	22,922	4,680	12,343	-	5,068	6,596	13,383	2,746	8,467
	Acanthuridae Total	**212,182**	**309,645**	**255,889**	**109,863**	**137,501**	**356,990**	**274,927**	**305,664**	**245,333**
Apogonidae	CARDINALFISHES	-	-	-	-	-	168	-	-	21
	IRIDESCENT CARDINALFISH	-	-	936	-	-	-	-	-	117
	Apogonidae Total	**-**	**-**	**936**	**-**	**-**	**168**	**-**	**-**	**138**
Aulostomidae	TRUMPETFISH	5,224	-	1,924	2,513	-	1,404	-	-	1,383
	Aulostomidae Total	**5,224**	**-**	**1,924**	**2,513**	**-**	**1,404**	**-**	**-**	**1,383**
Balistidae	BLACK TRIGGERFISH	-	-	1,372	-	-	610	6,160	1,421	1,195
	LAGOON TRIGGERFISH	444	-	-	-	-	-	665	-	139
	LEI TRIGGERFISH	313	-	-	-	-	-	106	-	52
	PINKTAIL DURGON	-	-	-	-	-	-	177	-	22
	REEF TRIGGERFISH	-	2,570	1,130	-	3,605	-	-	-	913
	TRIGGERFISH FAMILY	1,033	-	-	-	-	-	340	1,157	316
	Balistidae Total	**1,789**	**2,570**	**2,502**	**-**	**3,605**	**610**	**7,448**	**2,578**	**2,638**

Table 1 (continued)

Family	Common Name	TOTAL CATCH (lb) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
Bothidae	FLOWERY FLOUNDER	-	821	1,701	334	-	1,768	-	-	578
	Bothidae Total	**-**	**821**	**1,701**	**334**	**-**	**1,768**	**-**	**-**	**578**
Carangidae	AFRICAN POMPANO	17,783	4,086	-	-	6,379	-	-	-	3,531
	BARRED JACK	571	430	-	-	-	8,405	-	6,492	1,987
	BIGEYE SCAD	30,921	181,692	142,043	420,270	82,325	234,659	233,728	140,778	183,302
	BIGEYE TREVALLY	38,595	623	-	-	-	-	4,995	1,885	5,762
	BLACK TREVALLY	734	1,804	3,544	-	29,529	1,156	-	-	4,596
	BLUEFIN TREVALLY	299,771	487,493	670,540	273,322	291,571	215,767	215,944	433,055	360,933
	GIANT TREVALLY	277,020	203,598	719,131	71,838	533,401	206,951	291,446	192,514	311,987
	GOLDEN TREVALLY	3,317	911	2,093	-	-	-	-	3,336	1,207
	GREATER AMBERJACK	39,742	33,110	73,592	18,890	-	22,096	263,458	7,369	57,282
	ISLAND JACK	69,201	30,777	39,902	47,268	41,702	28,841	12,444	3,316	34,181
	JACK FAMILY	28,460	15,601	1,533	18,958	7,421	9,697	3,736	775	10,773
	LEATHERBACK	15,413	17,356	12,780	10,589	26,424	11,526	5,949	14,516	14,319
	MACKEREL SCAD	56,204	23,702	118,338	36,067	26,523	204,066	102,293	3,904	71,387
	RAINBOW RUNNER	30,800	52,115	2,276	9,554	-	5,781	-	-	12,566

Table 1 (continued)

Family	Common Name	TOTAL CATCH (lb) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
	THICK LIPPED JACK	-	-	2,333	-	-	-	247	-	322
	WHITEMOUTH TREVALLY	-	-	-	-	-	-	19,352	-	2,419
	Carangidae Total	**908,533**	**1,053,295**	**1,788,106**	**906,754**	**1,045,275**	**948,943**	**1,153,593**	**807,941**	**1,076,555**
Carcharhinidae	BLACK-TIPPED REEF SHARK	-	-	-	62,527	-	-	-	-	7,816
	GALAPAGOS SHARK	-	507,471	-	-	-	-	-	-	63,434
	Carcharhinidae Total	**-**	**507,471**	**-**	**62,527**	**-**	**-**	**-**	**-**	**71,250**
Chaetodontidae	BUTTERFLYFISHES	203	-	-	-	-	-	-	-	25
	LONGNOSE BUTTERFLYFISH	-	-	-	28	-	-	-	-	3
	RACOON BUTTERFLYFISH	-	-	-	-	155	344	-	-	62
	TEARDROP BUTTERFLYFISH	-	-	713	-	-	-	-	-	89
	Chaetodontidae Total	**203**	**-**	**713**	**28**	**155**	**344**	**-**	**-**	**180**
Chanidae	MILKFISH	55,218	-	47,983	-	604,393	22,380	6,737	4,205	92,615
	Chanidae Total	**55,218**	**-**	**47,983**	**-**	**604,393**	**22,380**	**6,737**	**4,205**	**92,615**
Cirrhitidae	BLACKSIDE HAWKFISH	-	-	-	1,632	-	-	-	-	204
	STOCKY HAWKFISH	3,821	12,681	7,846	9,405	13,474	4,531	5,280	4,162	7,650
	Cirrhitidae Total	**3,821**	**12,681**	**7,846**	**11,037**	**13,474**	**4,531**	**5,280**	**4,162**	**7,854**

Table 1 (continued)

Family	Common Name	TOTAL CATCH (lb) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
Congridae	MUSTACHE CONGER EEL	-	-	827	180	646	898	388	136	384
	Congridae Total	**-**	**-**	**827**	**180**	**646**	**898**	**388**	**136**	384
Diodontidae	SPINY PORCUPINEFISH	4,026	-	-	-	-	-	-	-	503
	Diodontidae Total	**4,026**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**503**
Fistulariidae	CORNETFISH	1,216	-	-	1,642	-	-	-	-	357
	Fistulariidae Total	**1,216**	**-**	**-**	**1,642**	**-**	**-**	**-**	**-**	**357**
Gobiidae	GOBY FAMILY	-	8	-	-	-	-	11	-	2
	Gobiidae Total	**-**	**8**	**-**	**-**	**-**	**-**	**11**	**-**	**2**
Holocentridae	BIGSCALE SOLDIERFISH	-	11,593	2,254	191	3,009	11,625	19,077	2,821	6,321
	BRICK SOLDIERFISH	-	102	-	-	-	-	-	158	33
	HAWAIIAN SQUIRRELFISH	-	341	-	-	-	1,605	-	-	243
	ROUGHSCALE SOLDIERFISH	-	-	-	-	3,753	2,045	-	-	725
	SABER SQUIRRELFISH	571	805	-	-	-	-	-	884	282
	SQUIRRELFISH FAMILY	-	2,777	-	-	-	-	853	1,267	612
	TAHITIAN SQUIRRELFISH	-	-	-	4,544	-	-	-	-	568

Table 1 (continued)

Family	Common Name	TOTAL CATCH (lb) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
	WHITETIP SOLDIERFISH	10,352	10,566	10,665	1,841	33,471	1,378	4,049	1,964	9,286
	YELLOWFIN SOLDIERFISH	-	-	6,286	-	-	-	-	-	786
	Holocentridae Total	**10,923**	**26,184**	**19,206**	**6,576**	**40,233**	**16,654**	**23,979**	**7,094**	**18,856**
Kuhlidae	HAWAIIAN FLAGTAIL	24,734	56,624	70,685	26,888	50,833	31,063	37,115	18,789	39,591
	Kuhlidae Total	**24,734**	**56,624**	**70,685**	**26,888**	**50,883**	**31,063**	**37,115**	**18,279**	**39,591**
Kyphosidae	GRAY CHUB	13,759	16,900	63,875	6,159	51,946	24,753	35,515	13,543	28,306
	HIGHFIN RUDDERFISH	21,347	22,968	36,337	14,901	43,255	34,353	21,657	7,295	25,264
	LOWFIN CHUB	16,449	2,364	1,045	4,342	6,172	6,155	8,279	2,590	5,925
	SEA CHUBS	1,871	-	-	4,500	-	-	6,214	-	1,573
	Kyphosidae Total	**53,426**	**42,232**	**101,256**	**29,902**	**101,373**	**65,260**	**71,664**	**23,428**	**61,068**
Labridae	BALDWINS WRASSE	17,124	21,433	4,224	1,694	7,085	9,170	6,385	3,658	8,847
	BIRD WRASSE	287	-	430	1,016	-	-	510	-	280
	BLACKSIDE RAZORFISH	-	-	827	-	656	-	-	-	185
	BLACKTAIL WRASSE	-	-	-	-	-	201	426	-	78
	CHRISTMAS WRASSE	2,314	995	-	1,223	3,373	329	1,728	418	1,297
	CIGAR WRASSE	-	1,198	-	-	-	-	-	-	150

Table 1 (continued)

Family	Common Name	TOTAL CATCH (lb) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
	DRAGON WRASSE	149	-	-	-	-	-	-	-	19
	HAWAIIAN HOGFISH	2,086	18,390	6,811	8,348	3,050	11,382	5,803	6,699	7,821
	ORNATE WRASSE	-	3,354	1,772	-	-	-	-	-	641
	PEACOCK RAZORFISH	152,789	123,558	63,455	21,912	27,695	45,105	31,193	13,661	59,921
	PEARL WRASSE	8,851	-	-	-	-	-	-	-	1,106
	PSYCHEDELIC WRASSE	6,942	2,759	-	-	1,618	-	-	-	1,415
	RAZORFISH GENUS	11,258	6,940	3,572	1,097	83	-	286	52	2,911
	RINGTAIL WRASSE	-	826	-	166	495	671	446	785	424
	SADDLE WRASSE	2,889	7,568	3,505	364	609	2,470	154	-	2,195
	WRASSE FAMILY	2,052	19,532	-	3,138	-	761	1,665	1,608	3,595
	YELLOWSTRIPE CORIS	-	-	2,122	-	-	-	-	-	265
	Labridae Total	**206,740**	**206,553**	**86,718**	**38,957**	**44,664**	**70,089**	**48,596**	**26,881**	**91,150**
Lethrinidae	BIGEYE EMPEROR	3,758	3,211	2,200	3,240	851	-	-	508	1,721
	Lethrinidae Total	**3,758**	**3,211**	**2,200**	**3,240**	**851**	**-**	**-**	**508**	**1,721**
Lutjanidae	BLACKTAIL SNAPPER	18,609	12,265	17,843	13,171	18,466	10,860	17,072	22,023	16,289
	BLUESTRIPE SNAPPER	28,529	65,849	23,287	14,328	17,096	26,522	37,864	10,552	28,003

Table 1 (continued)

Family	Common Name	TOTAL CATCH (lb) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
	GREEN JOBFISH	132,810	198,266	72,948	118,138	36,499	77,531	94,958	87,976	102,391
	SMALLTOOTH JOBFISH	-	877	-	-	-	3,612	283	-	596
	Lutjanidae Total	**179,948**	**277,256**	**114,078**	**145,636**	**72,062**	**118,525**	**150,177**	**120,551**	**147,279**
Monacanthidae	SCRAWLED FILEFISH	-	2,308	-	-	-	-	-	-	288
	Monacanthidae Total	**-**	**2,308**	**-**	**-**	**-**	**-**	**-**	**-**	**288**
Mullidae	BANDTAIL GOATFISH	574	-	4,349	1,831	6,672	797	9,580	4,447	3,531
	BLUE GOATFISH	4,965	7,116	9,387	5,987	5,673	2,932	17,030	11,024	8,014
	DOUBLEBAR GOATFISH	1,705	3,341	1,850	3,681	-	-	-	88	1,333
	GOATFISHES	-	68	267	-	-	-	-	241	72
	MANYBAR GOATFISH	20,070	13,939	37,235	40,372	14,636	17,161	35,608	9,235	23,532
	PFLUGERS GOATFISH	100,220	1,285	3,831	10,154	-	2,495	14,252	7,936	17,522
	SIDESPOT GOATFISH	-	3,746	1,712	-	-	777	-	-	779
	WHITESADDLE GOATFISH	13,759	13,875	12,817	23,739	7,461	8,776	9,358	10,425	12,526
	YELLOWFIN GOATFISH	40,148	46,955	13,927	17,677	7,645	26,301	18,949	1,951	21,694
	YELLOWSTRIPE GOATFISH	199,227	86,691	236,703	88,327	145,550	180,505	45,134	37,606	127,468
	Mullidae Total	**380,668**	**177,015**	**322,078**	**191,767**	**187,637**	**239,743**	**149,912**	**82,952**	**216,472**

Table 1 (continued)

Family	Common Name	TOTAL CATCH (lb) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
Muraenidae	DRAGON MORAY	-	4,915	-	-	-	-	-	-	614
	MORAY FAMILY	1,545	2,974	1,745	253	390	305	1,425	-	1,080
	NEEDLE-TOOTH MORAY	-	-	-	-	835	-	-	-	104
	STOUT MORAY EEL	1,620	-	-	-	-	330	-	-	244
	YELLOWHEAD MORAY EEL	-	-	790	-	-	576	-	-	171
	YELLOWMARGIN MORAY EEL	1,571	678	1,514	365	3,702	-	-	-	979
	ZEBRA MORAY EEL	-	-	59	-	-	-	-	-	7
	Muraenidae Total	**4,737**	**8,566**	**4,108**	**618**	**4,927**	**1,211**	**1,425**	**-**	**3,199**
Polynemidae	SIX-FINGERED THREADFIN	9,471	7,757	7,151	8,164	4,628	-	12,838	2,988	6,625
	Polynemidae Total	**9,471**	**7,757**	**7,151**	**8,164**	**4,628**	**-**	**12,838**	**2,988**	**6,625**
Pomacentridae	BLACKSPOT SERGEANT	31,777	16,609	11,502	10,677	6,002	10,586	4,019	2,798	11,746
	HAWAIIAN SERGEANT	4,214	13,786	26,273	3,603	3,420	3,700	8,384	788	8,021
	ROCK DAMSELFISH	1,293	843	-	-	-	3,033	5,613	667	1,431
	Pomacentridae Total	**37,284**	**31,239**	**37,775**	**14,280**	**9,422**	**17,319**	**18,015**	**4,254**	**21,198**
Priacanthidae	BIGEYE FAMILY	826	1,431	-	-	1,347	-	1,122	-	591
	GLASSEYE	1,418	564	1,381	-	-	-	-	-	420

Table 1 (continued)

Family	Common Name	TOTAL CATCH (lb) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
	HAWAIIAN BIGEYE	7,041	12,737	1,858	2,130	5,776	3,242	-	1,070	4,232
	Priacanthidae Total	**9,284**	**14,732**	**3,239**	**2,130**	**7,124**	**3,242**	**1,122**	**1,070**	**5,243**
Scaridae	BULLETHEAD PARROTFISH	12,171	8,289	19,864	1,899	188	-	214	9,577	6,525
	PALENOSE PARROTFISH	-	-	1,644	4,918	10,993	421	3,555	-	2,692
	PARROTFISH FAMILY	121,103	51,871	28,855	108,689	50,673	20,630	27,541	4,079	51,680
	REDLIP PARROTFISH	-	2,402	19,710	1,160	29,974	11,535	3,662	10,813	9,907
	REGAL PARROTFISH	-	-	1,600	-	-	-	228	-	228
	SPECTACLED PARROTFISH	7,151	22,280	11,878	11,907	4,893	8,963	2,984	5,494	9,444
	STAREYE PARROTFISH	-	1,370	3,373	-	3,229	-	2,993	1,827	1,599
	Scaridae Total	**140,424**	**86,212**	**86,924**	**128,573**	**99,951**	**41,549**	**41,177**	**31,790**	**82,075**
Scorpaenidae	HAWAIIAN LIONFISH	312	-	-	-	-	-	-	-	39
	SCORPIONFISH FAMILY	-	831	-	-	790	-	-	-	203
	TITAN SCORPIONFISH	4,197	8,496	972	5,167	4,814	-	1,165	-	3,101
	Scorpaenidae Total	**4,509**	**9,327**	**972**	**5,167**	**5,604**	**-**	**1,165**	**-**	**3,343**
Serranidae	PEACOCK GROUPER	-	12,296	6,793	1,868	31,143	-	1,037	6,699	7,479
	Serranidae Total	**-**	**12,296**	**6,793**	**1,868**	**31,143**	**-**	**1,037**	**6,699**	**7,479**

Table 1 (continued)

Family	Common Name	TOTAL CATCH (lb) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
Sphyraenidae	GREAT BARRACUDA	52,930	29,481	44,514	5,584	32,415	27,392	19,439	7,438	27,399
	HELLERS BARRACUDA	5,632	8,200	-	679	-	3,596	-	-	2,263
	Sphyraenidae Total	**58,562**	**37,681**	**44,514**	**6,263**	**32,415**	**30,988**	**19,439**	**7,438**	**29,662**
Synodontidae	LIZARDFISHES	-	-	-	-	-	-	6	-	1
	Synodontidae Total	**-**	**-**	**-**	**-**	**-**	**-**	**6**	**-**	**1**
Tetraodontidae	AMBON TOBY	-	-	-	-	-	29	-	-	4
	SPECKLED BALOONFISH	4,493	-	-	-	-	-	-	-	562
	STRIPEBELLY PUFFER	-	-	-	-	5,936	-	-	-	742
	Tetraodontidae Total	**4,493**	**-**	**-**	**-**	**5,936**	**29**	**-**	**-**	**1,307**
TOTAL – ALL REEF FISHES		**2,321,173**	**2,885,686**	**3,016,123**	**1,704,906**	**2,503,851**	**1,973,708**	**2,026,052**	**1,459,129**	**2,236,328**

Comparison with MRIP Catch-weight Estimates (without Re-Assessment) and with Commercial Catch Data

The small number of intercepts for the great majority of reef fish species limits the utility of the standard MRIP catch-weight estimates, such as those available from the MRIP data query webpage.[4] As described above, MRIP does not generate mean weight estimates for catch expansions unless there is a weight measurement in a fishing mode and area combination or there are at least two intercept weight-measurement records for a species for all fishing modes and areas combined in a wave. For reef fishes in Hawaii it is very common for that standard not to be met, as demonstrated by the fact that around two-thirds of reef-fish catch expansion records (i.e., estimated catch for a species, fishing mode, and fishing area in a wave) had no catch weight estimate. Using length-weight conversion to generate weight estimates from intercept records with length measurement but not weight measurements is one way to increase the number of useable intercept records for mean weight estimations (Figure A1). Even though such an approach was used there were still rather few intercept records with weight information for the majority of reef fish species (Table A3). Over the entire 8-year period (i.e., covering forty-eight 2-month waves in 2004-2011), 98 of 136 reef fish species had a total of < 10 intercepts with either a measured weight or length (40 had none at all), and only 9 species had > 100 intercept records across those 48 waves.

Unless there is a very substantial increase in the number of intercept measurements for reef fishes, this will be a persisting issue for MRIP catch expansion for weight, and re-assessments such as the ones we produce here will be necessary to generate useable catch weight estimates. Table 2 shows some examples of the scale of difference between our estimates, in which all catch records have a substitution weight, and the default MRIP estimates, for which many records have the weight field left blank. For those 5 commonly targeted reef fish families, re-assessed MRIP annual catch is between > 2 and nearly 20 times the total of known weights in the MRIP expansion.

Table 2.—Comparison of annual catch estimates for 2004–2011 from MRIP raw data and MRIP re-assessments with new weight substitution. Ratio is the ratio of the MRIP re-assessments using weight-substitutions generated for this report when MRIP did not generate a weight estimate.

Family	2004-2011 mean annual catch (lb)		Ratio
	MRIP	MRIP Re-assessment	
Acanthuridae	64,439	245,333	3.8
Scaridae	6,019	82,075	13.6
Mullidae	100,144	216,472	2.2
Holocentridae	5,578	18,856	3.4
Kyphosidae	3,200	61,068	19.1

[4] http://www.st.nmfs.noaa.gov/recreational-fisheries/access-data/run-a-data-query/index

To assess the importance of noncommercial reef fish catches in Hawaii, we compare our re-assessed MRIP recreational-fishery catch estimates with reported commercial catch for Hawaii (Table 3). Notably, the re-assessed MRIP estimated catch values are > 2 to > 4 times the reported commercial catch for all of the families examined, other than Holcentridae (Soldier/Squirrelfish), for which re-assessed MRIP catch was around half of the reported commercial catch.

Table 3.—Comparison of annual catch estimates (lb) for 2004-2009 from MRIP re-assessments and from commercial catch reports.

Family	2004-2009 annual mean catch (lb)		Ratio
	Commercial Catch	MRIP Re-assessment	
Acanthuridae	86,463	245,333	2.8
Scaridae	40,450	82,075	2.0
Mullidae	46,880	216,472	4.6
Holocentridae	43,436	18,856	0.4
Kyphosidae	28,228	61,068	2.2

Harvest Expansions

As described above, MRIP harvest estimates from 2004 to 2010 were divided by 1.22 to account for overestimation of fishing trips in that period. Total numbers of fish harvested (i.e., landed, excluding those released alive) per year per species were not otherwise adjusted (Table 4).

Table 4.—Annual estimated harvest (# individuals) and mean (2004-2011) by family and species for all reef species.

		HARVEST (# individuals)								
	Common Name	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**Annual Average**
Acanthuridae	ACHILLES TANG	-	-	-	6,876	3,671	-	1,793	131	1,559
	BLACK SURGEONFISH	-	24,410	-	12,520	134	6,803	18,378	5,051	8,412
	BLUE SPINE UNICORNFISH	10,362	17,501	12,134	8,247	7,627	10,458	12,108	1,933	10,046
	BLUELINED SURGEONFISH	-	3,322	845	-	-	-	460	-	578
	BROWN SURGEONFISH	-	-	-	-	-	-	23,475	-	2,934
	CONVICT TANG	98,107	342,072	344,544	77,436	127,047	618,981	207,015	137,888	244,136
	EYESTRIPED SURGEONFISH	28,378	26,756	28,943	8,320	22,022	22,722	33,884	19,811	23,855
	GOLDRING SURGEONFISH	162,919	88,154	91,166	54,436	97,666	190,665	92,106	54,286	103,925
	ORANGEBAND SURGEONFISH	849	849	2,297	-	-	-	8,189	-	1,523
	ORANGESPINE UNICORNFISH	10,490	-	3,162	-	4,395	-	1,319	-	2,421
	PALETAIL UNICORNFISH	-	-	-	-	-	-	-	180,316	22,540
	RINGTAIL SURGEONFISH	-	14,962	322	1,565	-	-	-	1,221	2,259
	SLEEK UNICORNFISH	-	782	-	-	624	1,511	-	-	365
	SURGEON FISH FAMILY	-	-	-	-	-	-	-	593	74
	UNICORN SURGEON GENUS	3,788	790	-	-	2,318	1,606	-	793	1,162
	WHITE BAR SURGEONFISH	-	-	-	1,210	-	-	-	-	151

Table 4 (continued)

	Common Name	HARVEST (# individuals) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
	WHITEMARGIN UNICORNFISH	8,147	5,882	2,628	208	-	3,601	1,273	-	2,717
	YELLOW TANG	3,936	-	-	20,587	-	-	-	-	3,065
	YELLOWFIN SURGEONFISH	6,539	849	3,521	-	1,446	1,558	3,818	973	2,338
	Acanthuridae Total	**333,515**	**526,330**	**489,564**	**191,405**	**266,951**	**857,906**	**403,816**	**402,996**	**434,060**
Apogonidae	CARDINALFISHES	-	-	-	-	-	2,110	-	-	264
	IRIDESCENT CARDINALFISH	-	-	3,380	-	-	-	-	-	422
	Apogonidae Total	**-**	**-**	**3,380**	**-**	**-**	**2,110**	**-**	**-**	**686**
Aulostomidae	TRUMPETFISH	2,603	-	959	1,252	-	700	-	-	689
	Aulostomidae Total	**2,603**	**-**	**959**	**1,252**	**-**	**700**	**-**	**-**	**689**
Balistidae	BLACK TRIGGERFISH	-	-	2,297	-	-	1,020	10,311	2,379	2,001
	LAGOON TRIGGERFISH	849	-	-	-	-	-	1,273	-	265
	LEI TRIGGERFISH	947	-	-	-	-	-	149	-	137
	PINKTAIL DURGON	-	-	-	-	-	-	149	-	19
	REEF TRIGGERFISH	-	1,620	938	-	2,992	-	-	-	694
	TRIGGERFISH FAMILY	869	-	-	-	-	-	286	973	266
	Balistidae Total	**2,665**	**1,620**	**3,234**	**-**	**2,992**	**1,020**	**12,169**	**3,352**	**3,382**

Table 4 (continued)

	Common Name	HARVEST (# individuals) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
Bothidae	FLOWERY FLOUNDER	-	1,490	2,911	541	-	2,785	-	-	966
	Bothidae Total	**-**	**1,490**	**2,911**	**541**	**-**	**2,785**	**-**	**-**	**966**
Carangidae	AFRICAN POMPANO	1,831	570	-	-	748	-	-	-	394
	BARRED JACK	2,591	216	-	-	-	4,217	-	2,572	1,199
	BIGEYE SCAD	70,221	559,437	481,176	837,724	288,925	590,645	553,740	655,606	504,684
	BIGEYE TREVALLY	9,776	257	-	-	-	-	1,273	1,140	1,556
	BLACK TREVALLY	333	1,818	1,148	-	63,030	172	-	-	8,313
	BLUEFIN TREVALLY	150,807	149,149	108,643	90,354	107,132	63,195	61,356	74,985	100,703
	GIANT TREVALLY	49,839	28,674	40,416	11,916	26,903	15,740	30,093	19,803	27,923
	GOLDEN TREVALLY	1,302	459	791	-	-	-	-	724	409
	GREATER AMBERJACK	3,559	1,742	4,157	672	-	868	13,860	395	3,157
	ISLAND JACK	25,463	12,033	15,965	15,762	21,440	10,884	4,039	1,498	13,385
	JACK FAMILY	29,346	16,087	1,581	19,548	7,652	9,998	3,852	799	11,108
	LEATHERBACK	19,924	17,633	15,731	11,816	33,716	12,091	7,185	13,426	16,440
	MACKEREL SCAD	76,627	35,791	184,051	54,963	40,212	313,008	134,916	6,462	105,754
	RAINBOW RUNNER	5,420	10,216	516	1,814	-	1,296	-	-	2,408

Table 4 (continued)

	Common Name	HARVEST (# individuals) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
	THICK LIPPED JACK	-	-	4,233	-	-	-	448	-	585
	WHITEMOUTH TREVALLY	-	-	-	-	-	-	1,170	-	146
	Carangidae Total	**447,040**	**834,081**	**858,409**	**1,044,569**	**589,761**	**1,022,115**	**811,934**	**777,410**	**798,165**
Carcharhinidae	BLACK-TIPPED REEF SHARK	-	-	-	1,210	-	-	-	-	151
	GALAPAGOS SHARK	-	5,774	-	-	-	-	-	-	722
	Carcharhinidae Total	**-**	**5,774**	**-**	**1,210**	**-**	**-**	**-**	**-**	**873**
Chaetodontidae	BUTTERFLYFISHES	947	-	-	-	-	-	-	-	118
	LONGNOSE BUTTERFLYFISH	-	-	-	270	-	-	-	-	34
	RACOON BUTTERFLYFISH	-	-	-	-	723	1,608	-	-	291
	TEARDROP BUTTERFLYFISH	-	-	2,822	-	-	-	-	-	353
	Chaetodontidae Total	**947**	**-**	**2,822**	**270**	**723**	**1,608**	**-**	**-**	**796**
Chanidae	MILKFISH	3,466	-	1,917	-	37,942	1,405	423	264	5,677
	Chanidae Total	**3,466**	**-**	**1,917**	**-**	**37,942**	**1,405**	**423**	**264**	**5,677**
Cirrhitidae	BLACKSIDE HAWKFISH	-	-	-	9,469	-	-	-	-	1,184
	STOCKY HAWKFISH	7,724	26,244	14,284	21,735	30,598	10,289	12,615	9,451	16,618

Table 4 (continued)

	Common Name	HARVEST (# individuals) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
	Cirrhitidae Total	**7,724**	**26,244**	**14,284**	**31,204**	**30,598**	**10,289**	**12,615**	**9,451**	**17,801**
Congridae	MUSTACHE CONGER EEL	-	-	959	208	748	1,041	450	158	446
	Congridae Total	**-**	**-**	**959**	**208**	**748**	**1,041**	**450**	**158**	**446**
Diodontidae	SPINY PORCUPINEFISH	1,302	-	-	-	-	-	-	-	163
	Diodontidae Total	**1,302**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**163**
Fistulariidae	CORNETFISH	849	-	-	832	-	-	-	-	210
	Fistulariidae Total	**849**	**-**	**-**	**832**	**-**	**-**	**-**	**-**	**210**
Gobiidae	GOBY FAMILY	-	3,758	-	-	-	-	4,804	-	1,070
	Gobiidae Total	**-**	**3,758**	**-**	**-**	**-**	**-**	**4,804**	**-**	**1,070**
Holocentridae	BIGSCALE SOLDIERFISH	-	20,470	4,952	541	6,593	21,811	33,631	1,862	11,233
	BRICK SOLDIERFISH	-	257	-	-	-	-	-	399	82
	HAWAIIAN SQUIRRELFISH	-	898	-	-	-	4,220	-	-	640
	ROUGHSCALE SOLDIERFISH	-	-	-	-	7,684	4,188	-	-	1,484
	SABER SQUIRRELFISH	337	475	-	-	-	-	-	522	167
	SQUIRRELFISH FAMILY	-	5,944	-	-	-	-	1,825	2,713	1,310
	TAHITIAN SQUIRRELFISH	-	-	-	3,262	-	-	-	-	408

Table 4 (continued)

	Common Name	HARVEST (# individuals) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
	WHITETIP SOLDIERFISH	30,146	30,769	8,380	2,088	49,684	4,014	4,304	5,720	16,888
	YELLOWFIN SOLDIERFISH	-	-	11,804	-	-	-	-	-	1,476
	Holocentridae Total	**30,483**	**58,814**	**25,136**	**5,891**	**63,961**	**34,233**	**39,761**	**11,216**	**33,687**
Kuhlidae	HAWAIIAN FLAGTAIL	102,646	157,999	118,802	146,089	189,937	146,991	183,501	66,949	139,114
	Kuhlidae Total	**102,646**	**157,999**	**118,802**	**146,089**	**189,937**	**146,991**	**183,501**	**66,949**	**139,114**
Kyphosidae	GRAY CHUB	6,541	6,249	25,618	2,474	20,961	9,984	14,330	2,560	11,090
	HIGHFIN RUDDERFISH	24,049	20,261	32,053	13,144	38,156	30,303	19,104	6,435	22,938
	LOWFIN CHUB	13,054	475	376	3,262	4,637	4,624	6,220	1,946	4,324
	SEA CHUBS	2,603	-	-	6,261	-	-	8,645	-	2,189
	Kyphosidae Total	**46,248**	**26,985**	**58,048**	**25,141**	**63,753**	**44,911**	**48,299**	**10,941**	**40,541**
Labridae	BALDWINS WRASSE	19,198	22,134	5,439	1,904	7,963	10,307	6,060	4,112	9,640
	BIRD WRASSE	1,302	-	2,876	6,787	-	-	3,409	-	1,797
	BLACKSIDE RAZORFISH	-	-	938	-	1,075	-	-	-	252
	BLACKTAIL WRASSE	-	-	-	-	-	693	1,467	-	270
	CHRISTMAS WRASSE	5,791	2,430	-	2,987	8,241	804	3,093	1,021	3,046
	CIGAR WRASSE	-	3,397	-	-	-	-	-	-	425

Table 4 (continued)

	Common Name	HARVEST (# individuals) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
	DRAGON WRASSE	849	-	-	-	-	-	-	-	106
	HAWAIIAN HOGFISH	1,671	5,907	3,426	3,585	1,332	5,752	3,127	2,563	3,420
	ORNATE WRASSE	-	5,210	1,148	-	-	-	-	-	795
	PEACOCK RAZORFISH	165,433	76,915	71,896	26,124	30,797	50,157	29,948	9,654	57,615
	PEARL WRASSE	3,936	-	-	-	-	-	-	-	492
	PSYCHEDELIC WRASSE	7,872	3,130	-	-	1,835	-	-	-	1,605
	RAZORFISH GENUS	87,325	53,829	27,703	8,510	643	-	2,216	407	22,579
	RINGTAIL WRASSE	-	1,269	-	255	760	1,030	854	1,122	661
	SADDLE WRASSE	19,815	34,212	22,590	3,906	5,830	15,532	966	-	12,856
	WRASSE FAMILY	1,302	12,391	-	1,991	-	483	1,057	1,020	2,280
	YELLOWSTRIPE CORIS	-	-	5,566	-	-	-	-	-	696
	Labridae Total	**314,494**	**220,823**	**141,583**	**56,048**	**58,476**	**84,759**	**52,196**	**19,899**	**118,535**
Lethrinidae	BIGEYE EMPEROR	2,841	2,475	1,663	2,449	643	-	-	384	1,307
	Lethrinidae Total	**2,841**	**2,475**	**1,663**	**2,449**	**643**	**-**	**-**	**384**	**1,307**
Lutjanidae	BLACKTAIL SNAPPER	23,646	20,794	27,020	21,270	16,061	18,332	27,967	28,595	22,961

Table 4 (continued)

	Common Name	HARVEST (# individuals) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
	BLUESTRIPE SNAPPER	47,629	81,969	38,411	22,679	26,184	43,783	55,356	16,687	41,587
	GREEN JOBFISH	22,254	29,761	17,052	9,752	6,073	12,168	18,041	18,532	16,704
	SMALLTOOTH JOBFISH	-	865	-	-	-	1,903	149	-	365
	Lutjanidae Total	**93,529**	**133,389**	**82,484**	**53,702**	**48,319**	**76,186**	**101,513**	**63,814**	**81,617**
Monacanthidae	SCRAWLED FILEFISH	-	7,434	-	-	-	-	-	-	929
	Monacanthidae Total	**-**	**7,434**	**-**	**-**	**-**	**-**	**-**	**-**	**929**
Mullidae	BANDTAIL GOATFISH	2,603	-	5,644	2,140	8,660	1,166	12,434	5,771	4,802
	BLUE GOATFISH	2,315	4,430	8,315	3,233	3,261	1,596	7,452	4,945	4,443
	DOUBLEBAR GOATFISH	2,004	3,959	2,157	4,316	-	-	-	131	1,571
	GOATFISHES	-	216	845	-	-	-	-	764	228
	MANYBAR GOATFISH	44,020	28,609	35,072	33,170	23,098	26,064	37,261	15,159	30,306
	PFLUGERS GOATFISH	37,080	475	1,417	3,757	-	923	6,772	2,936	6,670
	SIDESPOT GOATFISH	-	5,084	1,917	-	-	1,055	-	-	1,007
	WHITESADDLE GOATFISH	20,983	7,360	7,721	16,239	6,138	6,845	8,919	6,792	10,125
	YELLOWFIN GOATFISH	26,112	51,870	10,375	15,213	5,542	18,797	14,128	23,813	20,731
	YELLOWSTRIPE GOATFISH	451,129	264,291	592,607	166,020	336,857	528,141	134,516	112,330	323,236

Table 4 (continued)

	Common Name	HARVEST (# individuals) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
	Mullidae Total	**586,245**	**366,293**	**666,072**	**244,086**	**383,556**	**584,586**	**221,480**	**172,641**	**403,120**
Muraenidae	DRAGON MORAY	-	4,589	-	-	-	-	-	-	574
	MORAY FAMILY	3,396	6,536	3,835	557	857	670	3,132	-	2,373
	NEEDLE-TOOTH MORAY	-	-	-	-	1,835	-	-	-	229
	STOUT MORAY EEL	1,968	-	-	-	-	401	-	-	296
	YELLOWHEAD MORAY EEL	-	-	959	-	-	700	-	-	207
	YELLOWMARGIN MORAY EEL	1,968	849	1,897	457	4,637	-	-	-	1,226
	ZEBRA MORAY EEL	-	-	705	-	-	-	-	-	88
	Muraenidae Total	**7,332**	**11,975**	**7,396**	**1,014**	**7,330**	**1,771**	**3,132**	**-**	**4,994**
Polynemidae	SIX-FINGERED THREADFIN	15,521	4,031	5,614	6,542	3,766	-	10,079	2,041	5,949
	Polynemidae Total	**15,521**	**4,031**	**5,614**	**6,542**	**3,766**	**-**	**10,079**	**2,041**	**5,949**
Pomacentridae	BLACKSPOT SERGEANT	72,433	37,144	31,856	32,678	16,802	29,630	11,249	7,833	29,953
	HAWAIIAN SERGEANT	18,694	45,416	95,603	15,998	13,638	16,451	37,275	3,504	30,823
	ROCK DAMSELFISH	2,603	1,698	-	-	-	6,108	11,302	1,344	2,882

Table 4 (continued)

	Common Name	HARVEST (# individuals) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
	Pomacentridae Total	**93,730**	**84,259**	**127,459**	**48,676**	**30,439**	**52,189**	**59,827**	**12,681**	**63,658**
Priacanthidae	BIGEYE FAMILY	2,841	4,925	-	-	4,637	-	3,861	-	2,033
	GLASSEYE	3,936	1,565	3,835	-	-	-	-	-	1,167
	HAWAIIAN BIGEYE	16,289	22,266	3,487	2,841	10,516	6,189	-	2,043	7,954
	Priacanthidae Total	**23,066**	**28,757**	**7,322**	**2,841**	**15,152**	**6,189**	**3,861**	**2,043**	**11,154**
Scaridae	BULLETHEAD PARROTFISH	2,915	2,197	4,974	1,360	134	-	153	2,800	1,817
	PALENOSE PARROTFISH	-	-	234	2,038	5,345	175	1,473	-	1,158
	PARROTFISH FAMILY	25,818	9,947	3,855	21,317	9,205	3,398	4,174	545	9,782
	REDLIP PARROTFISH	-	431	2,971	208	4,295	1,799	657	1,604	1,496
	REGAL PARROTFISH	-	-	2,297	-	-	-	327	-	328
	SPECTACLED PARROTFISH	2,315	6,988	3,575	3,807	1,496	2,807	912	1,021	2,865
	STAREYE PARROTFISH	-	779	1,917	-	1,835	-	2,340	1,594	1,058
	Scaridae Total	**31,048**	**20,341**	**19,823**	**28,730**	**22,311**	**8,179**	**10,037**	**7,564**	**18,504**
Scorpaenidae	HAWAIIAN LIONFISH	947	-	-	-	-	-	-	-	118

Table 4 (continued)

	Common Name	HARVEST (# individuals) 2004	2005	2006	2007	2008	2009	2010	2011	Annual Average
	SCORPIONFISH FAMILY	-	799	-	-	760	-	-	-	195
	TITAN SCORPIONFISH	4,216	6,014	959	3,818	4,007	-	1,201	-	2,527
	Scorpaenidae Total	**5,163**	**6,813**	**959**	**3,818**	**4,767**	**-**	**1,201**	**-**	**2,840**
Serranidae	PEACOCK GROUPER	-	5,729	3,057	1,106	16,491	-	456	4,658	3,937
	Serranidae Total	**-**	**5,729**	**3,057**	**1,106**	**16,491**	**-**	**456**	**4,658**	**3,937**
Sphyraenidae	GREAT BARRACUDA	13,103	11,183	19,047	1,075	12,603	14,602	2,336	5,393	9,918
	HELLERS BARRACUDA	2,243	3,272	-	270	-	1,432	-	-	902
	Sphyraenidae Total	**15,346**	**14,455**	**19,047**	**1,346**	**12,603**	**16,034**	**2,336**	**5,393**	**10,820**
Synodontidae	LIZARDFISHES	-	-	-	-	-	-	286	-	36
	Synodontidae Total	**-**	**-**	**-**	**-**	**-**	**-**	**286**	**-**	**36**
Tetraodontidae	AMBON TOBY	-	-	-	-	-	802	-	-	100
	SPECKLED BALOONFISH	1,498	-	-	-	-	-	-	-	187
	STRIPEBELLY PUFFER	-	-	-	-	2,318	-	-	-	290
	Tetraodontidae Total	**1,498**	**-**	**-**	**-**	**2,318**	**802**	**-**	**-**	**577**
Grand Total		**2,169,300**	**2,549,870**	**2,662,903**	**1,898,970**	**1,853,537**	**2,957,811**	**1,984,175**	**1,573,855**	**2,206,303**

CONCLUSION

Results of our re-assessment of MRIP catch estimates, including that recreational catch is likely substantially higher than reported commercial catch for several families (Table 3), emphasize the importance of MRIP data for coral reef fisheries in Hawaii. It is therefore, a nontrivial concern that the paucity of intercept measurements for the majority of reef taxa in most waves significantly impacts the ability of the MRIP to generate reef fish catch weight estimates.

Our relatively simple solution is based on three things: (i) increasing the number of useable intercept weights by using length-weight conversions on intercept data with length only; (ii) calculating mean weights per taxa (by fishing mode where possible) across the entire 8-year period and using those as default substitution weights where MRIP was not able to estimate a substitution weight; and (iii) estimating plausible mean weights for the 39 reef-fish species for which there were no intercept lengths or weights in the entire 8-year period.

While our approach is straightforward and can be readily easily applied to future MRIP data sets, additional improvements in MRIP catch estimates would be possible if there were an increase in the number of weight and/or length measurements of reef fishes made during intercept surveys. Prioritizing species of particular interest (e.g., large component of recreational take), or those for which there is a reasonable expectation of large inter-annual or seasonal differences in catch weights, is likely more feasible than attempting to increase the number of intercept surveys for all 136 reef fish taxa.

REFERENCES

Froese, R., and D. Pauly.
2010. FishBase, electronic publication. http://www.fishbase.org.

Kulbicki, M., N. Guillemot, et al.
2005. A general approach to length-weight relationships for New Caledonian lagoon fishes. Cybium 29(3): 235-252.

Ma, H.
2013. Catch estimates for major pelagic species from the Hawaii Marine Recreational Fishing Survey (2003-2011). PIFSC Internal Report IR-13-006: 8p.

APPENDICES

APPENDIX A. FISH TAXON CLASSIFICATIONS

The MRIP estimation file contains species codes for 193 species. Twelve of those species (shown in Table A1) had no catch weight or harvest estimates – presumably because there was no recorded HARVEST (i.e., landed catch of those species) during intercept surveys. Records of fishes caught but returned alive would not be included in in the harvest. We considered 45 species as being not reef fish species (Table A2). Those are mostly pelagic, bottomfish, or are largely associated with soft-bottom habitats. The remaining 136 species, together with information on length-weight conversion factors, number of intercepts per fishing mode, and substitution weights, are shown in Table A3.

Table A1.—Fish species in the MRIP species table for Hawaii, but with no estimated HARVEST in 2004-2011. HARVEST as we use it here, means landings, i.e., does not include fishes that were caught but returned to the ocean alive.

Family	sp_code	Common Name	Taxon
Pomacentridae	8835620315	THREESPOT CHROMIS	*Chromis verater*
Diodontidae	8861030201	PORCUPINEFISH	*Diodon hystrix*
Bothidae	8857030000	LEFTEYE FLOUNDER FAMILY	Bothidae
Diodontidae	8861030000	PORCUPINEFISH FAMILY	Diodontidae
Synodontidae	8762020305	SLENDER LIZARDFISH	*Saurida elongate*
Tetraodontidae	8861010000	PUFFERS	Tetraodontidae
Carcharhinidae	8708020518	GRAY REEF SHARK	*Carcharhinus amblyrhynchos*
Carcharhinidae	8708021101	WHITE TIP REEF SHARK	*Triaenodon obesus*
Carcharhinidae	8708020503	SANDBAR SHARK	*Carcharhinus plumbeus*
Carcharhinidae	8708020000	REQUIEM SHARK FAMILY	Carcharinidae
Sphyrnidae	8708030103	SCALLOPED HAMMERHEAD	*Sphyrna lewini*
Labridae	8839012303	YELLOWTAIL CORIS	*Coris gaimard*

Table A2.—MRIP species considered not reef fish species.

Family	sp_code	Common Name	*Taxon*
Elopidae	8738010103	HAWAIIAN TENPOUNDER	*Elops hawaiensis*
Albulidae	8739010103	SMALLMOUTH BONEFISH	*Albula glossondonta*
Clupeidae	8747010000	HERRING FAMILY	Clupeidae
Clupeidae	8747011601	DELICATE ROUND HERRING	*Spratelloides delicatulus*
Clupeidae	8747013301	GOLDSPOT HERRING	*H. quadrimaculatus*
Engraulidae	8747020000	ANCHOVY FAMILY	Engraulidae
Engraulidae	8747020904	HAWAIIAN ANCHOVIES	*Encrasicholina purpurea*
Hemiramphidae	8803010299	HALFBEAK FISH FAMILY	Hemiramphidae
Hemiramphidae	8803010205	POLYNESIAN HALFBEAK	*Hemiramphus depauperatus*
Hemiramphidae	8803010314	ACUTE HALFBEAK	*Hyporhamphus acutus*
Belonidae	8803020000	NEEDLEFISH	Belonidae
Belonidae	8803020302	HOUNDFISH	*Tylosurus crocodilus*
Belonidae	8803020401	KEELTAIL NEEDLEFISH	*Platybelone argalus*
Atherinidae	8805020502	HAWAIIAN SILVERSIDE	*Atherinomorus insularum*
Notocheiridae	8805030101	HAWAIIAN SURF SARDINE	*Iso hawaiiensis*
Scorpaenidae	8826010507	LARGE HEADED SCORPIONFISH	*Pontinus macrocephalus*
Serranidae	8835020413	HAWAIIAN GROUPER	*Hyporthodus quernus*
Coryphaenidae	8835290101	DOLPHIN FISH	*Coryphaena hippurus*
Lutjanidae	8835360302	RUBY SNAPPER	*Etelis carbunculus*
Lutjanidae	8835360304	LONGTAILED RED SNAPPER	*Etelis coruscans*
Lutjanidae	8835360704	PINK SNAPPER	*Pristipomoides filamentosus*
Lutjanidae	8835360706	VON SIEBOLDS SNAPPER	*Pristipomoides sieboldii*
Lutjanidae	8835360707	BINGHAMS SNAPPER	*Pristipomoides zonatus*
Lutjanidae	8835360901	IRONJAW SNAPPER	*Aphareus rutilans*
Tilapia	8835610499	TILAPIA	Tilapia
Bramidae	8835710000	POMFRETS	Bramidae
Mugilidae	8836010000	MULLETS	Mugilidae
Mugilidae	8836010101	STRIPED MULLET	*Mugil cephalus*

Table A.2 (continued)

Family	sp_code	Common Name	*Taxon*
Mugilidae	8836010601	SHARPNOSE MULLET	*Neomyxus leuciscus*
Mugilidae	8836011806	SUMMER MULLET	*Valamugil engeli*
Gempylidae	8850010401	OILFISH	*Ruvettus pretiosus*
Scombridae	8850030101	SKIPJACK TUNA	*Katsuwonus pelamis*
Scombridae	8850030103	KAWAKAWA	*Euthynnus affinis*
Scombridae	8850030401	ALBACORE	*Thunnus alalunga*
Scombridae	8850030402	BLUEFIN TUNA	*Thunnus orientalis*
Scombridae	8850030403	YELLOWFIN TUNA	*Thunnus albacares*
Scombridae	8850030405	BIGEYE TUNA	*Thunnus obesus*
Scombridae	8850030601	WAHOO	*Acanthocybium solandri*
Scombridae	8850030702	FRIGATE MACKEREL	*Auxis thazard*
Istiophoridae	8850060000	BILLFISH FAMILY	Istiophoridae
Istiophoridae	8850060101	SAILFISH	*Istiophorus platypterus*
Istiophoridae	8850060201	BLUE MARLIN	*Makaira nigricans*
Istiophoridae	8850060202	BLACK MARLIN	*Makaira indica*
Istiophoridae	8850060305	SHORTBILL SPEARFISH	*Tetrapturus angustirostris*
Istiophoridae	8850060306	STRIPED MARLIN	*Tetrapturus audax*

Table A3.—Reef Fish Species in Hawaii MRIP Catch Expansions. sp_code is the species code used in MRIP database. The LW conversion factors come from the NOAA PIFSC CRED database used to generate biomass estimates from reef fish visual survey data. Original source for majority of those length-weight parameters is from FISHBASE (Froese and Pauly 2010)or Kulbicki et al (2005). L_CONV is a value to convert length as fork length (FL, the measurement used by MRIP) to the correct length type (standard length, total length, or fork length) for the LW parameters (N.B. is frequently 1, as many of these parameters were developed for lengths as FL). "# intercepts w/ measurements" is the total number of measured fishes in the 2004-2011 intercept dataset , tallied separately for 'BOAT' and 'SHORE" fishing modes. Substitution weights are the weights that are used where expanded catch estimates do not have estimated weights. For species with 2 or more measured fishes in the intercept data for both BOAT and SHORE fishing, substitution weights are calculated separately for BOAT and SHORE fishing, as averages weights across 2004-2011 for that species. For species with intercept data, but < 2 for one or both of those fishing modes, substitution weight is mean from all intercept data (all modes) for that species. For species where no fishes have been measured in 2004-2011 (i.e. # intercepts w/measurement is 0 for both BOAT and SHORE), substitution weight for both BOAT and SHORE is estimated using LW parameters based on an assumed size of fish (A_FL). Comments field takes one of three values: "No intercept data", insufficient intercept data to calculate separate substitutions for BOAT and SHORE ("Average all intercepts"), or, where there were more than 2 measured fishes for both fishing mode, then "Boat/Shore Separate". 'Hvst Shre %' is the percentage of estimated harvest that is from SHORE fishing – that information included as context to the information on number of intercept measurements per fishing mode.

Species Information				Length-Weight Conversion Factors			# intercepts w/ measurement		Substitution Weight (lb)		Hvst Shre		
Family	sp_code	Common Name	Taxon	LW_a	LW_b	L_CONV	BOAT	SHORE	BOAT	SHORE	%	A_FL (cm)	Comments
Acanthuridae	8849010000	SURGEON FISH FAMILY	Acanthuridae	0.028	2.983	1.111	0	0	0.273	0.273	0%	15	No intercept data
Acanthuridae	8849010107	YELLOWFIN SURGEONFISH	*Acanthurus xanthopterus*	0.027	2.984	1.000	0	4	3.505	3.505	81%	NA	Average all intercepts
Acanthuridae	8849010108	EYESTRIPED SURGEONFISH	*Acanthurus dussumieri*	0.043	2.868	1.000	14	33	2.857	1.182	83%	NA	Boat/Shore Separate
Acanthuridae	8849010109	ACHILLES TANG	*Acanthurus achilles*	0.025	3.000	1.070	1	1	0.953	0.953	29%	NA	Average all intercepts
Acanthuridae	8849010112	WHITE BAR SURGEONFISH	*Acanthurus leucopareius*	0.003	3.000	1.050	0	0	0.057	0.057	100%	20	No intercept data
Acanthuridae	8849010114	BROWN SURGEONFISH	*Acanthurus nigroris*	0.021	2.944	1.136	0	2	0.942	0.942	100%	NA	Average all intercepts
Acanthuridae	8849010115	BLUELINED SURGEONFISH	*Acanthurus nigrofuscus*	0.026	3.028	1.000	0	1	0.661	0.661	70%	NA	Average all intercepts

Table A3 (continued)

Species Information				Length-Weight Conversion Factors			# intercepts w/ measurement		Substitution Weight (lb)		Hvst Shre		
Family	sp_code	Common Name	Taxon	LW_a	LW_b	L_CONV	BOAT	SHORE	BOAT	SHORE	%	A_FL (cm)	Comments
Acanthuridae	8849010116	ORANGEBAND SURGEONFISH	*Acanthurus olivaceous*	0.038	3.055	1.000	1	3	1.934	1.934	62%	NA	Average all intercepts
Acanthuridae	8849010118	CONVICT TANG	*Acanthurus triostegus*	0.083	2.570	1.000	14	90	0.309	0.318	89%	NA	Boat/Shore Separate
Acanthuridae	8849010122	RINGTAIL SURGEONFISH	*Acanthurus blochii*	0.025	3.032	1.000	3	3	3.366	0.914	88%	NA	Boat/Shore Separate
Acanthuridae	8849010200	UNICORN SURGEON GENUS	*Naso spp.*	0.008	3.250	1.000	0	0	0.652	0.652	100%	25	No intercept data
Acanthuridae	8849010201	BLUE SPINE UNICORNFISH	*Naso unicornis*	0.018	3.035	1.000	5	14	2.115	2.621	82%	NA	Boat/Shore Separate
Acanthuridae	8849010202	WHITEMARGIN UNICORN	*Naso annulatus*	0.051	2.715	1.000	2	4	2.767	2.092	88%	NA	Boat/Shore Separate
Acanthuridae	8849010203	PALETAIL UNICORNFISH	*Naso brevirostris*	0.011	3.243	1.000	0	0	0.802	0.802	100%	25	No intercept data
Acanthuridae	8849010204	SLEEK UNICORNFISH	*Naso hexacanthus*	0.042	2.854	1.000	0	2	9.853	9.853	79%	NA	Average all intercepts
Acanthuridae	8849010205	ORANGESPINE UNICORNFISH	*Naso lituratus*	0.009	3.250	1.000	0	1	0.841	0.841	80%	NA	Average all intercepts
Acanthuridae	8849010301	BLACK SURGEONFISH	*Ctenochaetus hawaiiensis*	0.016	3.012	1.040	0	4	0.869	0.869	92%	NA	Average all intercepts
Acanthuridae	8849010302	GOLDRING SURGEONFISH	*Ctenochaetus strigosus*	0.022	3.000	1.070	15	12	0.459	0.339	52%	NA	Boat/Shore Separate
Acanthuridae	8849010501	YELLOW TANG	*Zebrasoma flavescens*	0.015	3.160	1.000	0	0	0.170	0.170	16%	15	No intercept data
Apogonidae	8835180000	CARDINALFISHES	Apogonidae	0.015	3.121	1.000	0	0	0.080	0.080	100%	12	No intercept data
Apogonidae	8835180123	IRIDESCENT CARDINALFISH	*Apogon kallopterus*	0.010	3.314	1.000	0	1	0.277	0.277	100%	NA	Average all intercepts
Aulostomidae	8819010102	TRUMPETFISH	*Aulostomus chinensis*	0.000	3.514	1.000	0	2	2.006	2.006	100%	NA	Average all intercepts
Balistidae	8860020000	TRIGGERFISH FAMILY	Balistidae	0.006	3.554	1.000	0	0	1.189	1.189	46%	25	No intercept data

Table A3 (continued)

Species Information				Length-Weight Conversion Factors			# intercepts w/ measurement		Substitution Weight (lb)		Hvst Shre		
Family	sp_code	Common Name	Taxon	LW_a	LW_b	L_CONV	BOAT	SHORE	BOAT	SHORE	%	A_FL (cm)	Comments
Balistidae	8860020601	BLACK TRIGGERFISH	*Melichthys niger*	0.006	3.554	1.000	1	0	0.597	0.597	34%	NA	Average all intercepts
Balistidae	8860020602	PINKTAIL DURGON	*Melichthys vidua*	0.006	3.554	1.000	0	0	1.189	1.189	0%	25	No intercept data
Balistidae	8860021101	LAGOON TRIGGERFISH	*Rhinecanthus aculeatus*	0.052	2.641	1.000	0	2	0.522	0.522	100%	NA	Average all intercepts
Balistidae	8860021102	REEF TRIGGERFISH	*Rhinecanthus rectangulus*	0.052	2.641	1.000	1	1	1.205	1.205	86%	NA	Average all intercepts
Balistidae	8860021201	LEI TRIGGERFISH	*Sufflamen bursa*	0.022	3.000	1.000	1	1	0.711	0.711	86%	NA	Average all intercepts
Bothidae	8857030605	FLOWERY FLOUNDER	*Bothus mancus*	0.010	3.189	1.000	0	6	0.592	0.592	100%	NA	Average all intercepts
Carangidae	8835280000	JACK FAMILY	Carangidae	0.008	3.197	1.000	0	0	0.970	0.970	45%	30	No intercept data
Carangidae	8835280201	AFRICAN POMPANO	*Alectis ciliaris*	0.041	2.850	1.123	2	1	8.525	8.525	71%	NA	Average all intercepts
Carangidae	8835280307	BLACK TREVALLY	*Caranx lugubris*	0.020	3.001	1.000	2	5	6.714	0.992	99%	NA	Boat/Shore Separate
Carangidae	8835280310	GIANT TREVALLY	*Caranx ignobilis*	0.023	2.977	1.000	43	81	18.678	7.952	81%	NA	Boat/Shore Separate
Carangidae	8835280311	BLUEFIN TREVALLY	*Caranx melampygus*	0.029	2.974	1.000	93	158	3.509	3.294	79%	NA	Boat/Shore Separate
Carangidae	8835280312	BIGEYE TREVALLY	*Caranx sexfasciatus*	0.020	2.986	1.000	4	1	3.924	3.924	19%	NA	Average all intercepts
Carangidae	8835280601	BIGEYE SCAD	*Selar crumenophthalmus*	0.010	3.194	1.000	15	97	0.504	0.281	61%	NA	Boat/Shore Separate
Carangidae	8835280801	GREATER AMBERJACK	*Seriola dumerili*	0.022	2.940	1.128	9	1	19.009	19.009	19%	NA	Average all intercepts
Carangidae	8835281201	MACKEREL SCAD	*Decapterus macarellus*	0.008	3.140	1.110	51	4	0.659	0.485	3%	NA	Boat/Shore Separate
Carangidae	8835281301	RAINBOW RUNNER	*Elagatis bipinnulata*	0.014	2.920	1.000	14	2	4.461	5.628	74%	NA	Boat/Shore Separate
Carangidae	8835281701	WHITEMOUTH TREVALLY	*Uraspis helvola*	0.008	3.197	1.000	0	1	16.535	16.535	100%	NA	Average all intercepts
Carangidae	8835281901	GOLDEN TREVALLY	*Gnathanodon speciosus*	0.020	2.995	1.000	2	3	2.646	2.548	76%	NA	Boat/Shore Separate

Table A3 (continued)

Species Information				Length-Weight Conversion Factors			# intercepts w/ measurement		Substitution Weight (lb)		Hvst Shre		
Family	sp_code	Common Name	Taxon	LW_a	LW_b	L_CONV	BOAT	SHORE	BOAT	SHORE	%	A_FL (cm)	Comments
Carangidae	8835282001	BARRED JACK	*Carangoides ferdau*	0.037	2.851	1.000	0	5	1.993	1.993	94%	NA	Average all intercepts
Carangidae	8835282004	ISLAND JACK	*C. orthogrammus*	0.016	3.026	1.000	53	34	2.992	2.599	57%	NA	Boat/Shore Separate
Carangidae	8835282501	THICK LIPPED JACK	*Pseudocaranx cheilio*	0.027	2.886	1.000	0	1	0.551	0.551	90%	NA	Average all intercepts
Carangidae	8835282802	LEATHERBACK	*Scomberoides lysan*	0.011	2.923	1.000	9	45	1.171	0.914	92%	NA	Boat/Shore Separate
Carcharhinidae	8708020515	GALAPAGOS SHARK	*C. galapagensis*	0.002	3.373	1.000	0	0	87.892	87.892	0%	140	No intercept data
Carcharhinidae	8708020520	BLACK-TIPPED REEF SHARK	*C. melanopterus*	0.001	3.340	1.223	0	0	51.682	51.682	100%	120	No intercept data
Chaetodontidae	8835550000	BUTTERFLYFISHES	Chaetodontidae	0.030	2.990	1.000	0	0	0.214	0.214	100%	15	No intercept data
Chaetodontidae	8835550115	RACOON BUTTERFLYFISH	*Chaetodon lunula*	0.030	2.990	1.000	0	0	0.214	0.214	100%	15	No intercept data
Chaetodontidae	8835550122	TEARDROP BUTTERFLYFISH	*Chaetodon unimaculatus*	0.053	2.833	1.000	0	0	0.252	0.252	100%	15	No intercept data
Chaetodontidae	8835550902	LONGNOSE BUTTERFLYFISH	*Forcipiger spp.*	0.014	3.000	1.000	0	0	0.103	0.103	0%	15	No intercept data
Chanidae	8771010101	MILKFISH	*Chanos chanos*	0.005	3.389	1.000	0	4	15.929	15.929	94%	NA	Average all intercepts
Cirrhitidae	8835640201	BLACKSIDE HAWKFISH	*Paracirrhites forsteri*	0.017	3.125	1.000	0	0	0.172	0.172	100%	15	No intercept data
Cirrhitidae	8835640401	STOCKY HAWKFISH	*Cirrhitus pinnulatus*	0.021	3.000	1.000	0	22	0.440	0.440	99%	NA	Average all intercepts
Congridae	8741120103	MUSTACHE CONGER EEL	*Conger cinereus*	0.001	3.127	1.000	0	1	0.863	0.863	86%	NA	Average all intercepts
Diodontidae	8861030202	SPINY PORCUPINEFISH	*Diodon holocanthus*	0.068	2.784	1.000	0	1	3.093	3.093	100%	NA	Average all intercepts
Holocentridae	8810080000	SQUIRRELFISH FAMILY	Holocentridae	0.022	3.059	1.000	0	0	0.467	0.467	74%	20	No intercept data
Holocentridae	8810080119	HAWAIIAN SQUIRRELFISH	*S. xantherythrum*	0.022	3.047	1.000	0	1	0.380	0.380	82%	NA	Average all intercepts
Holocentridae	8810080203	BIGSCALE SOLDIERFISH	*Myripristis berndti*	0.028	3.003	1.000	6	9	0.860	0.431	77%	NA	Boat/Shore Separate

Table A3 (continued)

Species Information				Length-Weight Conversion Factors			# intercepts w/ measurement		Substitution Weight (lb)		Hvst Shre		
Family	sp_code	Common Name	Taxon	LW_a	LW_b	L_CONV	BOAT	SHORE	BOAT	SHORE	%	A_FL (cm)	Comments
Holocentridae	8810080205	YELLOWFIN SOLDIERFISH	*Myripristis chryseres*	0.028	3.030	1.000	0	0	0.533	0.533	0%	20	No intercept data
Holocentridae	8810080212	WHITETIP SOLDIERFISH	*Myripristis vittata*	0.028	3.030	1.000	2	9	1.676	0.343	92%	NA	Boat/Shore Separate
Holocentridae	8810080219	BRICK SOLDIERFISH	*Myripristis amaena*	0.016	3.261	1.000	2	0	0.397	0.397	0%	NA	Average all intercepts
Holocentridae	8810080402	ROUGHSCALE SOLDIERFISH	*Plectrypops lima*	0.018	3.139	1.000	1	0	0.488	0.488	0%	NA	Average all intercepts
Holocentridae	8810080901	SABER SQUIRRELFISH	*Sargocentron spiniferum*	0.015	3.119	1.000	2	0	1.694	1.694	0%	NA	Average all intercepts
Holocentridae	8810080907	TAHITIAN SQUIRRELFISH	*Sargocentron tiere*	0.023	3.000	1.000	0	0	1.393	1.393	100%	30	No intercept data
Kuhlidae	8835140101	HAWAIIAN FLAGTAIL	*Kuhlia sandwicensis*	0.016	3.034	1.000	1	108	0.251	0.251	1%	NA	Average all intercepts
Kyphosidae	8835510000	SEA CHUBS	Kyphosidae	0.013	3.151	1.000	0	0	0.719	0.719	100%	25	No intercept data
Kyphosidae	8835510103	HIGHFIN RUDDERFISH	*Kyphosus cinerascens*	0.028	2.860	1.089	0	20	1.134	1.134	98%	NA	Average all intercepts
Kyphosidae	8835510104	GRAY CHUB	*Kyphosus bigibbus*	0.028	2.860	1.000	6	13	2.513	2.478	81%	NA	Boat/Shore Separate
Kyphosidae	8835510105	LOWFIN CHUB	*Kyphosus vaigiensis*	0.020	3.037	1.000	2	8	4.973	1.331	98%	NA	Boat/Shore Separate
Labridae	8839010000	WRASSE FAMILY	Labridae	0.011	3.178	1.000	0	2	1.576	1.576	97%	NA	Average all intercepts
Labridae	8839010303	HAWAIIAN HOGFISH	*Bodianus bilunulatus*	0.015	3.000	1.063	21	3	2.290	1.597	24%	NA	Boat/Shore Separate
Labridae	8839010711	ORNATE WRASSE	*Halichoeres ornatissimus*	0.013	3.000	1.000	0	1	0.177	0.177	100%	NA	Average all intercepts
Labridae	8839010800	RAZORFISH GENUS	*Iniistius spp.*	0.011	3.178	1.000	0	0	0.129	0.129	8%	15	No intercept data
Labridae	8839010806	PEACOCK RAZORFISH	*Iniistius pavo*	0.011	3.178	1.000	199	3	0.899	0.279	2%	NA	Boat/Shore Separate
Labridae	8839010808	BLACKSIDE RAZORFISH	*Iniistius umbrilatus*	0.011	3.178	1.000	0	2	0.610	0.610	100%	NA	Average all intercepts
Labridae	8839010812	BALDWINS WRASSE	*Iniistius baldwini*	0.011	3.178	1.000	37	1	0.890	0.890	2%	NA	Average all intercepts

Table A3 (continued)

Species Information				Length-Weight Conversion Factors			# intercepts w/ measurement		Substitution Weight (lb)		Hvst Shre		
Family	sp_code	Common Name	Taxon	LW_a	LW_b	L_CONV	BOAT	SHORE	BOAT	SHORE	%	A_FL (cm)	Comments
Labridae	8839011002	BLACKTAIL WRASSE	*Thalassoma ballieui*	0.012	3.097	1.000	0	0	0.290	0.290	100%	20	No intercept data
Labridae	8839011004	SADDLE WRASSE	*Thalassoma duperrey*	0.012	3.097	1.000	0	37	0.159	0.159	100%	NA	Average all intercepts
Labridae	8839011019	CHRISTMAS WRASSE	*Thalassoma trilobatum*	0.016	2.972	1.000	0	4	0.409	0.409	100%	NA	Average all intercepts
Labridae	8839011301	PEARL WRASSE	*Anampses cuvier*	0.023	2.793	1.000	0	1	2.249	2.249	100%	NA	Average all intercepts
Labridae	8839011302	PSYCHEDELIC WRASSE	*A. chrysocephalus*	0.023	2.793	1.000	0	1	0.882	0.882	100%	NA	Average all intercepts
Labridae	8839011401	CIGAR	*Cheilio inermis*	0.003	3.082	1.000	0	4	0.353	0.353	100%	NA	Average all intercepts
Labridae	8839011510	RINGTAIL WRASSE	*Oxycheilinus unifasciatus*	0.017	3.000	1.000	4	0	0.651	0.651	19%	NA	Average all intercepts
Labridae	8839012001	BIRD WRASSE	*Gomphosus varius*	0.024	2.703	1.000	0	3	0.150	0.150	100%	NA	Average all intercepts
Labridae	8839012302	YELLOWSTRIPE CORIS	*Coris flavovittata*	0.035	3.000	1.000	0	1	0.381	0.381	100%	NA	Average all intercepts
Labridae	8839013002	DRAGON WRASSE	*N. taeniourus*	0.013	2.910	1.000	0	0	0.175	0.175	100%	20	No intercept data
Lethrinidae	8835420301	BIGEYE EMPEROR	*Monotaxis grandoculis*	0.023	3.022	1.000	2	0	1.323	1.323	74%	NA	Average all intercepts
Lutjanidae	8835360114	BLUESTRIPE SNAPPER	*Lutjanus kasmira*	0.008	3.247	1.000	51	17	0.675	0.485	31%	NA	Boat/Shore Separate
Lutjanidae	8835360115	BLACKTAIL SNAPPER	*Lutjanus fulvus*	0.021	2.974	1.000	6	34	0.691	0.578	82%	NA	Boat/Shore Separate
Lutjanidae	8835360801	GREEN JOBFISH	*Aprion virescens*	0.023	2.886	1.000	101	7	6.256	4.258	21%	NA	Boat/Shore Separate
Lutjanidae	8835360902	SMALLTOOTH JOBFISH	*Aphareus furca*	0.011	3.000	1.151	3	0	1.898	1.898	0%	NA	Average all intercepts
Monacanthidae	8860020104	SCRAWLED FILEFISH	*Aluterus scriptus*	0.002	3.000	1.000	0	0	0.310	0.310	31%	40	No intercept data
Mullidae	8835450000	GOATFISHES	Mullidae	0.007	3.293	1.000	0	0	0.316	0.316	88%	20	No intercept data

Table A3 (continued)

Species Information				Length-Weight Conversion Factors			# intercepts w/ measurement		Substitution Weight (lb)		Hvst Shre		
Family	sp_code	Common Name	Taxon	LW_a	LW_b	L_CONV	BOAT	SHORE	BOAT	SHORE	%	A_FL (cm)	Comments
Mullidae	8835450102	YELLOWSTRIPE GOATFISH	*M. flavolineatus*	0.009	3.060	1.093	4	109	0.889	0.328	99%	NA	Boat/Shore Separate
Mullidae	8835450103	YELLOWFIN GOATFISH	*M. vanicolensis*	0.010	3.015	1.131	37	30	2.262	0.603	74%	NA	Boat/Shore Separate
Mullidae	8835450104	PFLUGERS GOATFISH	*Mulloidichthys pfluegeri*	0.013	3.049	1.148	6	0	2.703	2.703	9%	NA	Average all intercepts
Mullidae	8835450403	BANDTAIL GOATFISH	*Upeneus arge*	0.010	3.215	1.000	1	5	0.771	0.771	76%	NA	Average all intercepts
Mullidae	8835450502	DOUBLEBAR GOATFISH	*Parupeneus insularis*	0.014	3.067	1.100	3	3	0.668	0.913	67%	NA	Boat/Shore Separate
Mullidae	8835450503	SIDESPOT GOATFISH	*Parupeneus pleurostigma*	0.012	3.000	1.100	0	3	0.737	0.737	37%	NA	Average all intercepts
Mullidae	8835450504	WHITESADDLE GOATFISH	*Parupeneus porphyreus*	0.015	3.000	1.100	4	20	2.509	1.156	86%	NA	Boat/Shore Separate
Mullidae	8835450505	MANYBAR GOATFISH	*P. multifasciatus*	0.011	3.211	1.000	31	69	0.806	0.493	58%	NA	Boat/Shore Separate
Mullidae	8835450507	BLUE GOATFISH	*Parupeneus cyclostomus*	0.012	3.000	1.100	20	7	1.837	1.751	38%	NA	Boat/Shore Separate
Muraenidae	8741050000	MORAY FAMILY	Muraenidae	0.005	2.614	1.000	0	0	0.455	0.455	98%	60	No intercept data
Muraenidae	8741050202	ZEBRA MORAY EEL	*Gymnomuraena zebra*	0.001	3.303	1.000	0	0	0.083	0.083	100%	30	No intercept data
Muraenidae	8741050410	YELLOWMARGIN MORAY EEL	*G. flavimarginatus*	0.000	3.350	1.000	0	0	0.798	0.798	100%	60	No intercept data
Muraenidae	8741050412	STOUT MORAY EEL	*Gymnothorax eurostus*	0.001	3.303	1.000	0	0	0.823	0.823	100%	60	No intercept data
Muraenidae	8741050434	YELLOWHEAD MORAY EEL	*Gymnothorax rueppelliae*	0.001	3.303	1.000	0	0	0.823	0.823	100%	60	No intercept data
Muraenidae	8741050503	DRAGON MORAY	*Enchelycore pardalis*	0.025	2.908	1.000	0	0	1.071	1.071	100%	30	No intercept data
Muraenidae	8741050713	NEEDLE-TOOTH MORAY	*U. macrocephalus*	0.005	2.614	1.000	0	0	0.455	0.455	100%	60	No intercept data
Polynemidae	8838010106	SIX-FINGERED THREADFIN	*Polydactylus sexfilis*	0.014	3.117	1.000	1	13	1.274	1.274	98%	NA	Average all intercepts
Pomacentridae	8835620103	HAWAIIAN SERGEANT	*Abudefduf abdominalis*	0.023	3.132	1.000	0	63	0.225	0.225	96%	NA	Average all intercepts

Table A3 (continued)

Species Information				Length-Weight Conversion Factors			# intercepts w/ measurement		Substitution Weight (lb)		Hvst Shre		
Family	sp_code	Common Name	Taxon	LW_a	LW_b	L_CONV	BOAT	SHORE	BOAT	SHORE	%	A_FL (cm)	Comments
Pomacentridae	8835620104	BLACKSPOT SERGEANT	*Abudefduf sordidus*	0.025	3.000	1.080	0	37	0.357	0.357	100%	NA	Average all intercepts
Pomacentridae	8835620904	ROCK DAMSELFISH	*Stegastes fasciolatus*	0.035	2.911	1.131	0	1	0.497	0.497	100%	NA	Average all intercepts
Priacanthidae	8835170000	BIGEYE FAMILY	Priacanthidae	0.029	2.807	1.000	0	0	0.291	0.291	97%	20	No intercept data
Priacanthidae	8835170102	GLASSEYE	*H. cruentatus*	0.028	2.823	1.000	0	5	0.360	0.360	100%	NA	Average all intercepts
Priacanthidae	8835170104	HAWAIIAN BIGEYE	*Priacanthus meeki*	0.029	2.807	1.000	1	16	0.524	0.524	84%	NA	Average all intercepts
Scaridae	8839030000	PARROTFISH FAMILY	Scaridae	0.022	2.971	1.000	3	2	7.485	4.404	71%	NA	Boat/Shore Separate
Scaridae	8839030107	SPECTACLED PARROTFISH	*Chlorurus perspicillatus*	0.020	3.000	1.000	3	10	2.269	3.271	78%	NA	Boat/Shore Separate
Scaridae	8839030108	REGAL PARROTFISH	*Scarus dubius*	0.022	2.971	1.000	0	0	0.697	0.697	88%	25	No intercept data
Scaridae	8839030113	BULLETHEAD PARROTFISH	*Chlorurus sordidus*	0.024	2.969	1.000	2	3	1.396	4.176	72%	NA	Boat/Shore Separate
Scaridae	8839030146	PALENOSE PARROTFISH	*Scarus psittacus*	0.010	3.319	1.000	4	2	2.414	2.002	50%	NA	Boat/Shore Separate
Scaridae	8839030151	REDLIP PARROTFISH	*Scarus rubroviolaceus*	0.014	3.109	1.099	3	2	5.570	7.218	64%	NA	Boat/Shore Separate
Scaridae	8839030603	STAREYE PARROTFISH	*Calotomus carolinus*	0.012	3.167	1.000	0	3	1.760	1.760	98%	NA	Average all intercepts
Scorpaenidae	8826010000	SCORPIONFISH FAMILY	Scorpaenidae	0.013	3.261	1.000	0	0	1.040	1.040	0%	25	No intercept data
Scorpaenidae	8826011301	TITAN SCORPIONFISH	*Scorpaenopsis cacopsis*	0.025	2.908	1.000	0	18	1.184	1.184	100%	NA	Average all intercepts
Scorpaenidae	8826011502	HAWAIIAN LIONFISH	*Dendrochirus barberi*	0.025	2.908	1.000	0	0	0.329	0.329	100%	20	No intercept data
Serranidae	8835024612	PEACOCK GROUPER	*Cephalopholis argus*	0.009	3.181	1.000	4	4	2.419	0.928	41%	NA	Boat/Shore Separate
Sphyraenidae	8837010104	GREAT BARRACUDA	*Sphyraena barracuda*	0.006	3.011	1.000	9	26	9.259	1.174	84%	NA	Boat/Shore Separate
Sphyraenidae	8837010106	HELLERS BARRACUDA	*Sphyraena helleri*	0.006	3.019	1.000	7	0	2.511	2.511	55%	NA	Average all intercepts

Table A3 (continued)

Species Information				Length-Weight Conversion Factors			# intercepts w/ measurement		Substitution Weight (lb)		Hvst Shre		
Family	sp_code	Common Name	Taxon	LW_a	LW_b	L_CONV	BOAT	SHORE	BOAT	SHORE	%	A_FL (cm)	Comments
Synodontidae	8762020000	LIZARDFISHES	Synodontidae	0.008	3.078	1.000	0	0	0.022	0.022	0%	10	No intercept data
Tetraodontidae	8861010302	STRIPEBELLY PUFFER	*Arothron hispidus*	0.063	2.756	1.000	0	2	2.561	2.561	100%	NA	Average all intercepts
Tetraodontidae	8861010303	SPECKLED BALOONFISH	*Arothron meleagris*	0.408	2.703	1.000	0	1	2.998	2.998	100%	NA	Average all intercepts
Tetraodontidae	8861010402	AMBON TOBY	*Canthigaster amboinesis*	0.020	2.917	1.000	0	0	0.360	0.360	100%	10	No intercept data

APPENDIX B. FIXES MADE TO INTERCEPT DATA

In the course of generating substitution weights for Hawaii MRIP reef fish species, we came across a number of apparent errors in the MRIP intercept data files, i.e. where species, length or weight seemed unlikely or impossible. In consultation with Tom Ogawa, the HMRFS (DAR) project manager, we made corrections for those records in our data files before calculating substitution weights, largely based on values read from hard copies of the original intercepts (Table B1).

Table B1.--Corrections to MRIP records. LNGTH is fork length (mm) and WGT is weight (kg).

Error	Correction
Bigscale soldier fish with WGT = 1.68	WGT deleted. LNGTH (278) kept.
Mackerel scad with WGT = 3.25	Species changed to Island jack
Mackerel scad with WGT = 2.0	WGT changed to 0.2
Green jobfish with WGT = 25 and LNGTH = 564	WGT changed to 2.5
Yellowstripe goatfish with LNGTH = 850	LNGTH changed to 85
Yellowfin goatfish with LNGTH = 910	LNGTH changed to 91
Peacock razorfish with WGT = 6.4	WGT changed to 0.4
Palenose parrotfish with LNGTH = 542	Species changed to Redlip Parrotfish
Manybar goatfish with WGT = 3.38	WGT changed to 0.38
Manybar goatfish with WGT = 2.0	WGT changed to 0.2
Manybar goatfish with WGT = 3.0	WGT changed to 0.3
Manybar goatfish with LNGTH = 2335	LNGTH changed to 235
Trumpetfish with LNGTH = 1219	Species changed to Cornetfish
Ambon toby with LNGTH = 410	Species changed to Stripebelly pufferfish
Blueline surgeonfish with LNGTH = 420	Species changed to Bluespine unicornfish
Blueline surgeonfish with LNGTH = 431	Species changed to Ringtail surgeonfish
Orangeband surgeon with LNGTH = 457	LNGTH changed to 356
Eyestriped surgeon with LNGTH = 356	LNGTH changed to 457
Ornate wrasse with LNGTH > 200 (2 records)	Species changed to Wrasse family
Yellow tang with LNGTH = 769	Intercept record removed from database – LNGTH was wrong, but was also an aquarium fish catch.
Multiple records with species of Bandtail parrotfish. Species (Scarus taeniurus) is not found in Hawaii. Most likely mis-ID would be for Palenose parrotfish (Scarus psittacus).	Species set to Parrotfish family when LNGTH > 300, otherwise to Palenose parrotfish. 300 mm is max length of Palenose parrotfish.
Bullethead parrotfish records with LNGTH > 420 (> max size of the species)	Species set to 'Parrotfish family'
Saddle wrasse with LNGTH = 1222	LNGTH set to 122
Hawaiian Flagtail with LNGTH = 780	LNGTH set to 78

APPENDIX C. LENGTH-WEIGHT INTERCEPT DATA

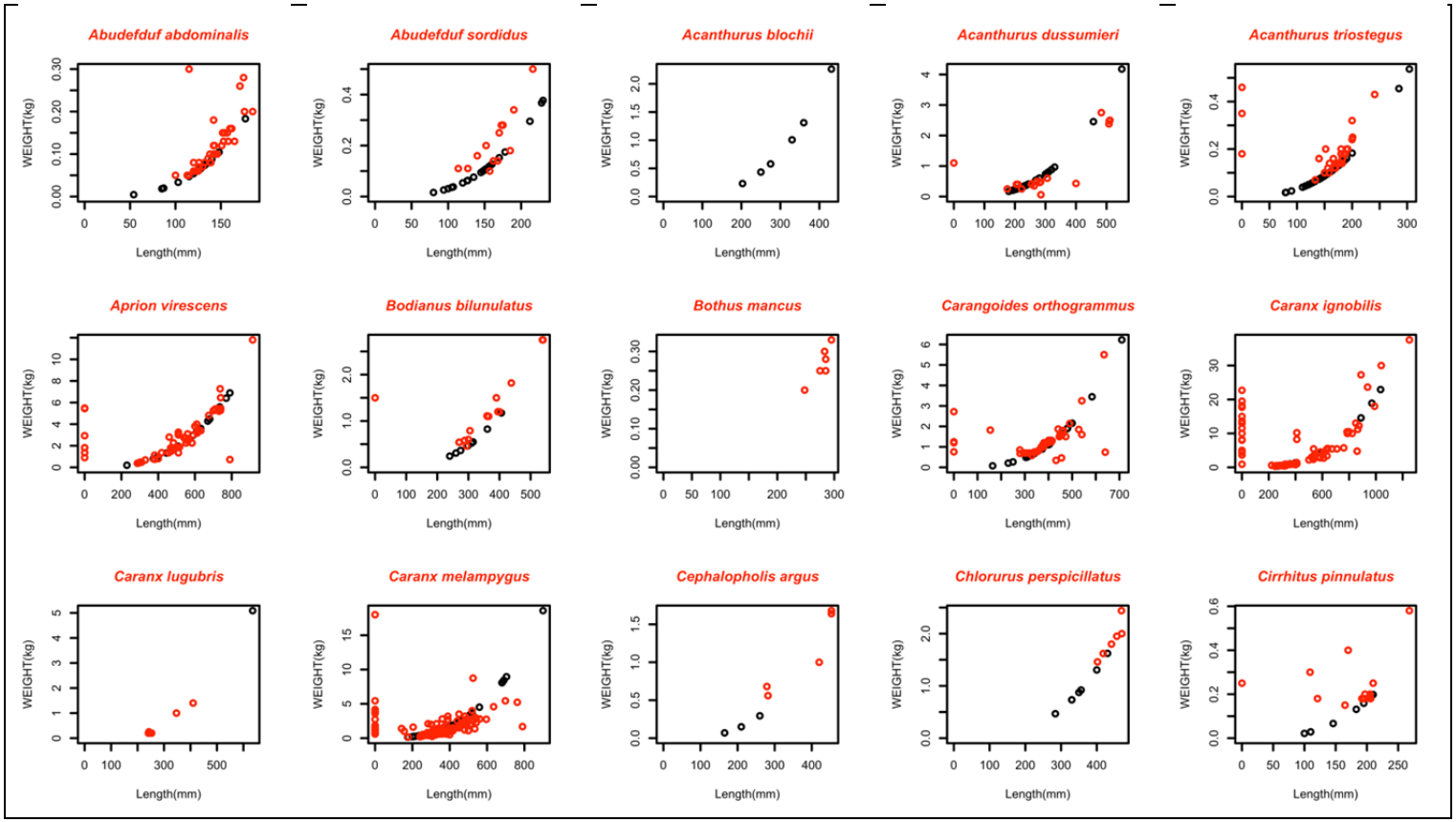

Figure C1.-- **Length and Weight Information for All Reef Fish Species With > 5 Intercept Records with Either Length or Weight in the 2004–2011 HMRFS Intercept Data**. Red points are records with a measured weight from intercepts, black points are intercept records where there was a measured length but no weight data – for those fishes, weight is estimated from the length-weight conversion shown in Table A3. Note that there are several records with weight but missing length (i.e., length appears to be zero in figures above). For those records, only intercept weight is used in the substitution-weight calculations (i.e., faulty or missing length data is not important if there is a weight measurement). Length measurements are only used for intercept records where there is no weight measurement.

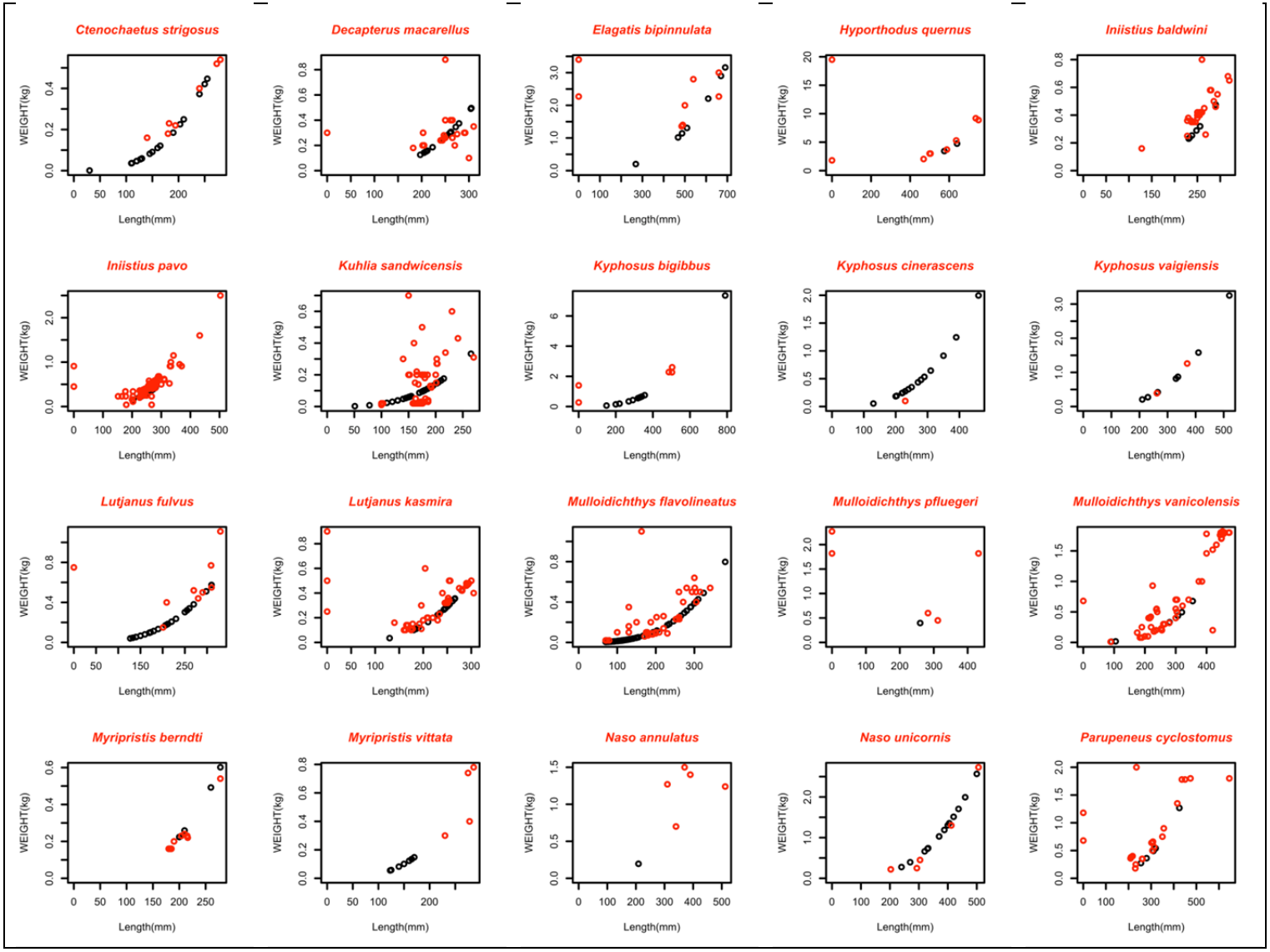

Figure C1 (continued)

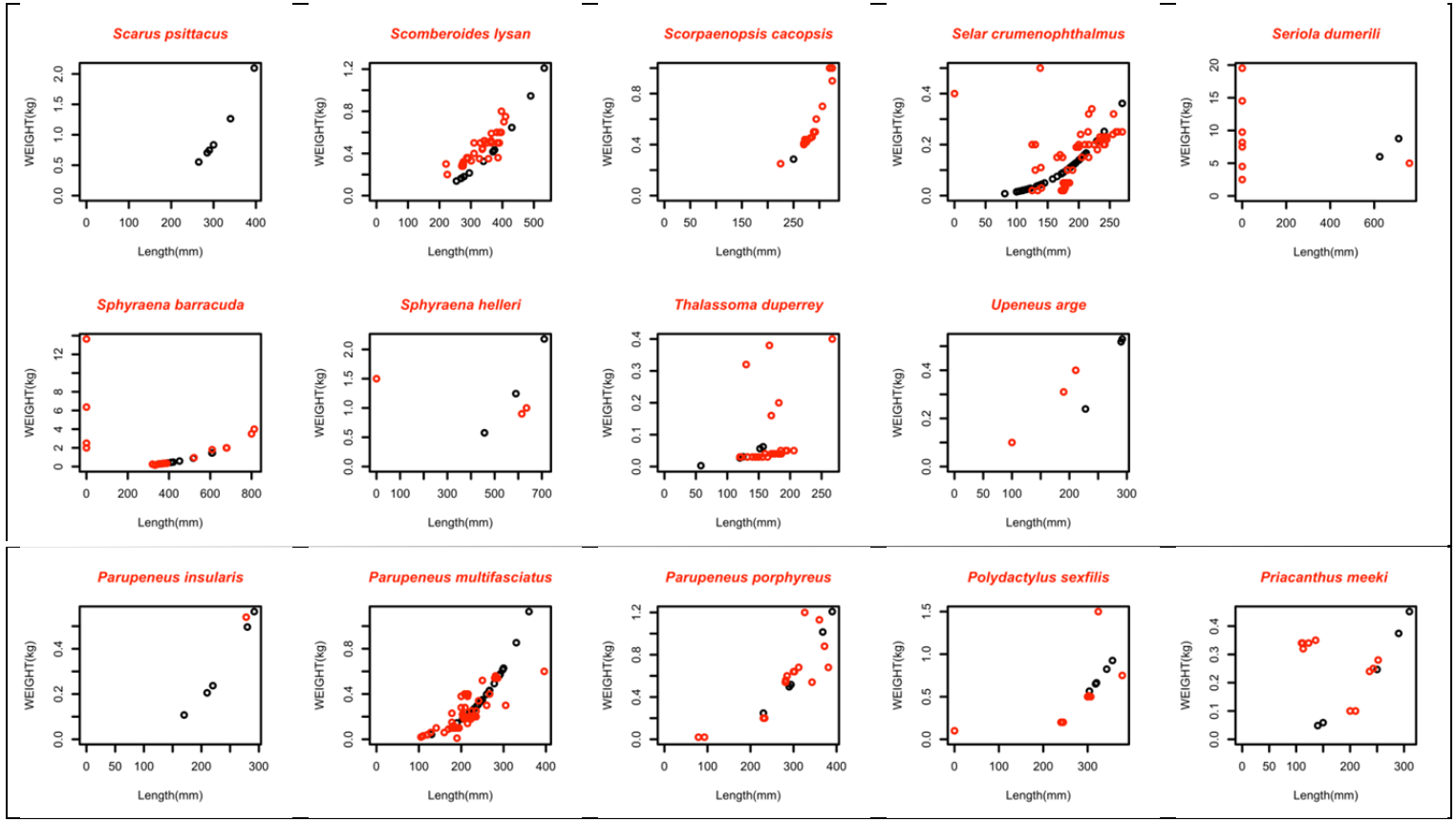

Figure C1 (continued)